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The government commission on possible reduction in lake level due to the operation of the Chicago Drainage Canal has commenced its investigations. The commission, consisting of Gen. O. M. Poe, Major Ruffner and Major Marshall, all of the Corps of Engineers, U. S. A., has examined the drainage canal itself in company with the engineers of the canal, and it will next probably measure the flow at the St. Clair River and at Niagara. Gen. Poe said that at present no one could tell accurately what effect the canal would have upon the level of the lakes; but that the outflow through the canal might reduce the lake level somewhere between 3 ins. and 8 ins. The present mean flow through the St. Clair River is about 225,000 cu. ft. per second, and through the Niagara River, 265,000 cu. ft. per second, according to the best available data. The drainage canal would draw off 10,000 cu. ft. per second. The mean annual fluctuation between high and low water in the lakes, due to natural causes, on the other hand, varies from 1.2 ft. in Lake Superior, to 2.07 ft. in Lake Ontario, but these fluctuations vary greatly in different years. Meanwhile, the Canadian engineers are joining the Lake Carriers' Association in agitating this question, in connection with the effect of the reduced flow in the St. Lawrence River.

The surveys and reports upon the proposed Lake Erie and Ohio ship-canals will be completed about Sept. 30, and it is expected that the final report will then appear.

The official opening of the Canadian ship-canal at Sault Ste. Marie may be delayed until next year, owing to differences between the government and the contractors, and to some incompleted and unsatisfactory work on the approaches.

The waterways of France, according to recent statistics, include 7,930 miles of canals and rivers open to navigation. Of this aggregate 2,986 miles consist of canals, and 2,232 miles of rivers that have been deepened and artificially canalized. The principal waterways, 2,513 miles in all, are 6½ ft. deep, with locks permitting the passage of boats 125 ft. long by 16½ ft. beam and carrying 300 tons. In 1893 these canals carried 25,504,330 metric tons of freight; and the kilometric tonnage was 3,603,653,008 tons, or about one-fiftieth of the ton-mileage of the railways of the United States the same year. Of this freight, 57.3% was carried on the canals and 42.7% on the navigable rivers. The canals of the first class described above carry 91% of all the tonnage. In this century alone the French government has expended nearly $300,000,000 upon the construction and maintenance of these canals and river improvements, and the annual repair account is about $5,000,000. These canals are free, no toll being collected.

The American Line steamship "St. Louis," on her official trial off Southampton, on Aug. 20, maintained a speed of 22.3 knots for four hours over a 52-knot course at sea. With the tide she made 23.6 knots per hour. The "St. Louis" used her ordinary coal and practically natural draft, the screw making 95 revolutions per minute. By this remarkable performance the American-built steamship wins a 10-year mail-carrying contract with the U. S. Government at the rate of $4 per mile for a weekly service between New York and Southampton.

The steel steamship "Comanche," built by Wm. Cramp & Sons, of Philadelphia, for the Clyde Line to Florida, was launched this week. The "Comanche" is 330 ft. long, 46 ft. beam and has a tonnage of 3,500 tons. Her quadruple expansion engines are expected to develop a speed of 15 to 16 knots per hour, and thus reduce the sailing time between New York and Jacksonville, Fla., to 2½ days, or just 24 hours less than the present schedule.

A fleet of six steel canal boats which left Lorain, O., on Aug. 11, loaded with steel rails, bound for Brooklyn, N. Y., via Lake Erie, the Erie Canal and the Hudson River, reached Buffalo on Aug. 14. The boats were built by the Globe Iron Works, of Cleveland, O., for the Cleveland Steel Canal Boat Co., and are the first of their type that have been built for this purpose—viz., the carrying of materials from ports of the Great Lakes through to New York without transshipment at Buffalo. Each of the boats is 98 ft. long, 17 ft. 11 ins. wide, and draws 6 ft. of water loaded. From deck to keel the height is 10 ft. The capacity of each is 250 tons. The propeller barge, which tows the other five boats and is of the same size, is fitted with a compound engine developing 120 H.P. The speed of the fleet in open water is about six miles an hour.

A Black Sea-Baltic ship canal is again talked of, though all plans are as yet speculative. The projected route, starting at Riga, on the Baltic, would follow the Rivers Dwina, Berisina and Dnieper, ending at Cherson, on the Black Sea. The canal proper would consist in the connection of the two first above-named rivers. The total contemplated length of this waterway from sea to sea would be something over 1,000 miles, and the projected canal would have a minimum top width of 220 ft., a bottom width of 120 ft. and a least depth of 29 ft. The published plans as to lockage required are very obscure; but it is estimated that the total cost of construction, including necessary land, would not exceed $100,000,000. At an average speed of six knots the canal could be traversed in about six days. The whole canal would lie in Russian territory, and the incentive for construction would probably be rather military than commercial.

The project for the construction of a canal connecting the Danube and the Moldau and Elbe rivers is being revived at Vienna. The headwaters of the Moldau, a branch of the Elbe River, approach closely to the Danube watershed, near Linz, in Upper Austria, and it is through this elevated and mountainous section that the connecting canal would have to be built. Some years ago the enterprise was vigorously agitated by Austria, North Germany, and the navigation companies of the Danube and the Elbe. A subvention of $60,000,000 was offered by the chief cities of Austria and Bohemia, and plans were devised by eminent engineers. This scheme for connecting the North Sea with the Black Sea by a long inland waterway lay dormant, however, until the opening of the Kiel ship canal brought it forward again. From the little information available as to route and capacity the prospects for construction do not look encouraging.

Two 1,000-ton revenue cutters have been contracted for by the Government. One, to be called the "Manning," is to be built by the Atlantic Iron Works, of Boston, and the other, the "Gresham," is to be built by the Globe Shipbuilding Co., of Cleveland, O. The "Manning" will be a composite vessel, and the "Gresham" will be of steel throughout. The principal dimensions of each vessel are: Length, 205 ft. 6 ins.; beam, 32 ft.; mean draft, 12 ft. 3 ins.; displacement, 980 tons; horse power, 2,000, at 160 revs. per min. Estimated speed, 16 knots. The engines are to be of the vertical inverted, triple-expansion type, with cylinders 25, 37½ and 56¼ ins. diameter, and a stroke of 30 ins. The main condenser has a cooling surface of about 3,000 sq. ft. There are four single-ended steel boilers of the Scotch marine type. The total heating surface will be 5,200 sq. ft., measured on the outer surfaces of the tubes, and the total grate surface about 182. Forced draft will be furnished. Each vessel will be provided with a hydro-pneumatic ash ejector, a navy distilling and evaporating apparatus, and a complete electric light installation. A searchlight will be carried on the pilot house.

An experimental tank for testing models of war ships is about to be constructed at the Washington Navy Yard. It will be about 70 ft. long, 30 ft. wide and 12 ft. deep, and will be first used for testing models of battle-ships Nos. 5 and 6, the designs of which are now being prepared at the Navy Department.

Rockets as hurricane signals at night are to be tried by the Weather Bureau; and the signal station at New York and other important Atlantic ports have been furnished with them. The signal is auxiliary to the regular day hurricane signal flags. The rockets used will be mortar bombs exploding with a loud report at a height of 400 to 500 ft. The Bureau has also made arrangements for the display of hurricane signal flags by the regular lines of steamships plying along the coast.

The most serious accident of the week was a rear-end collision which occurred on the Camden & Atlantic R. R. at Liberty Park, N. J., on Aug. 15, killing two persons and injuring ten or more others. A mail train ran into an excursion train while the latter was stopping at the station. The collision is said to have been due to the error of the block signal operator at Collingwood, the station below Liberty Park, who had given the clear signal to the mail train when he had received no message from Liberty Park that the excursion train had passed that point.

A boiler exploded in the Gumry Hotel in Denver, Colo., on Aug. 19, demolishing the entire rear portion of the building and causing the death of probably 25 persons and a property loss of about $75,000. After the explosion the ruins of the building caught fire, cremating many of the victims. The press despatches thus far received do not clearly indicate the cause of the explosion, but it appears that the boiler had been left temporarily in charge of a 17-year-old boy, who was under the influence of liquor when he went on duty.

A train ran into an open switch on the Chicago & Northwestern R. R. on Aug. 16, and collided with some box cars standing on the siding, which were loaded with carboys of sulphuric acid. Several boys who were playing the vicinity were badly burned by the escaping acid, one of them fatally. Four persons on the train were severely injured by the collision.

A collision between a trolley car and a shifting engine and car on the Baltimore & Ohio R. R., near Chester, Pa., took place on Aug. 13. The motorman did not see the engine and car coming until it was too late to avoid the collision.

An explosion took place in Furnace H, of the Carnegie Steel Co., at Braddock, Pa., on Aug. 20, killing eight men and injuring eight others, two of them mortally. Before the accident the furnace was badly "hung," or "scaffolded," and then the bell and hopper became clogged. Sixteen men were sent to the top of the furnace to clear out the bell, and had partly completed their work when the scaffold fell, and volumes of flame and hot material were blown out of the top of the furnace and enveloped the workmen. There must have been some kind of a gas explosion, for the sound was heard all over the town of Braddock and over a mile from the works.

"Black damp," or the poisonous gases of combustion of powder, caused the death of five men while working in a deep rock cut on the Pittsburg & Eastern R. R. in Clearfield County, Pa., on Aug. 16. A blast of 300 kegs of powder had been put off, and the men had returned to perform their duties, when one at a time they fell and died, and five were dead before the others knew of it. It is stated that the poisonous gas arose from beneath the rock from a mine which had been abandoned about 20 years.

A chemical fire extinguisher exploded at the Catholic Protectory at West Chester, N. Y., on Aug. 20, killing one man and seriously wounding another. The two men were carrying the extinguisher between them at the time. It is described as a cylinder 2 ft. long, 6 ins. diameter, holding about three gallons of carbonate of soda and a glass vessel of sulphuric acid. The head of the cylinder blew off, and the cylinder itself was thrown 25 ft. into the air.

The Railroad Commissioners of Massachusetts have issued a street car-fender circular, calling upon all street railways in the state to comply with its regulations by Nov. 14, 1895. This circular applies for the present to all towns of over 7,500 inhabitants, and to all cars run by a street railway company, except cars run by horses or used as trailers. The companies can select from two methods: (1) A fender in front of the car, going in either direction, and with wheel-guards under the car; or (2), a combined fender and wheel-guard in front of the car. In the first case there must be a netting, platform, or similar device arranged to pick up a standing person with reasonable safety; but the wheel-guards are to be depended upon for preventing injury, as far as practicable, to a person fallen or thrown down. In the other case, one device must provide for both contingencies by permitting lowering of the fender by the motorman. The Commissioners do not find any one form or design of fender so unquestionably superior to others as to justify its sale and exclusive use. It therefore deems it better to permit the use of different types with the hope that the test of actual operation will develop a satisfactory fender.

THE THREE-PHASE ELECTRICAL TRANSMISSION PLANT AT SILVERTON, COLO.

In the table of plants in various parts of the world for the long distance transmission of power by electricity, which was printed in our issue of July 25, there appeared a brief mention of a three-phase plant at Silverton, Colo., which had then been running about three months. We have been furnished by the General Electric Co., the contractor for the plant, with some more detailed information concerning it, which we give below.

The combined water power and electric installation has been substituted for a steam engine, to run the concentrating mill of the Silver Lake group of mines, situated about four miles southeast from Silverton, and 12,300 ft. above the sea level. The steam engine formerly used required coal to be transported up a zig-zag mountain path, and its cost, delivered at the furnace, was $8.75 per ton, or over $1,000 per month. The water which furnishes the power is brought from the Animas River, above Silverton, through a 3 × 4-ft. flume, 9,750 ft. in length, which carries 2,350 cu. ft. of water per minute. The country is exceedingly rough, and some extensive trestling, to carry the flume, was required. The accompanying cut shows a portion of the flume carried on a trestle over a ravine.

The head of water obtained at the power house is about 180 ft., developing 640 HP. on the water-wheel shaft. The plant at the wheel-house consists of two 4-ft. double-nozzle Pelton wheels, belted to two 150-K.W. (200 HP.) General Electric Co.'s three-phase generators, which produce a current of 2,500 volts. The current is carried three miles to the Silver Lake mill and mine over a most rugged country by No. 3 B. & S. bare copper wires, one for each of the three-phase circuits. Special precautions are taken to insure complete insulation and lightning protection, as the country is subjected to frequent and violent thunder storms. At each insulator the wire is run through a short piece of rubber tube. In addition to the usual lightning arresters at each end of the line, an additional protection is provided in the shape of a barbed iron wire, which extends the entire distance of the line along the top of the poles, and is grounded at every second pole.

At the mill the current is supplied directly to a 100-HP. three-phase induction motor, and after being reduced to 220 volts by step-down transformers, it is led to other motors of 100 HP. and 75 HP., located underground, to a 15-HP. motor, which drives a pump supplying water to the mill and to a 1-HP. motor, which drives a blower. The mill and other buildings are also lit from the secondary circuit.

THE PROPOSED NEW YORK-PHILADELPHIA SHIP CANAL.

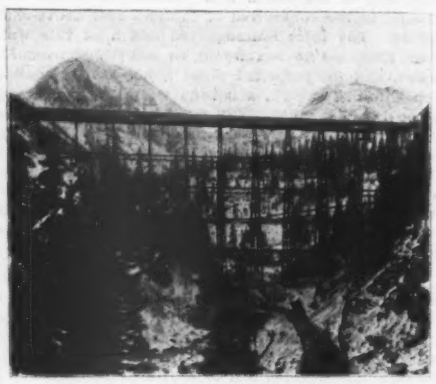
An official report has been transmitted to the Councils of the City of Philadelphia by the commission appointed in July, 1894, to investigate the feasibility of constructing a ship canal across the state of New Jersey and connecting the cities of Philadelphia and New York. The present report is upon the progress made, and embodies the official reports of Mr. N. H. Hutton, Consulting Engineer, and of Mr. L. M. Haupt, M. Am. Soc. C. E., Engineer in Charge.

The necessary surveys have been made to determine the most feasible route for a canal; the underlying soil has been investigated, and the general technical results have been recorded in the reports referred to. Two routes present themselves, both including the use of 27 miles of the Delaware River, between Philadelphia and Bordentown, and from 7 to 15 miles of the Raritan River and Bay, according to the depth adopted for the canal. Both routes leave the Delaware River near Bordentown, and ascend by locks to the plateau, which ranges in elevation from 60 to 100 ft. above tide, and extends across the state of New Jersey on the line surveyed. The first line would then connect with the Delaware & Raritan Canal, a few miles east of Trenton, and follow that canal to near Kingston; thence easterly by way of Monmouth Junction, to Lawrence Brook and the Raritan River. The serious objections to this line are the necessity for twice crossing the main line of the Pennsylvania R. R., and the unfavorable nature of the ground between the canal and Monmouth Junction. These difficulties were considered so serious by the engineers that though the route was surveyed, no estimates of cost were made.

The other route, from the same beginning, follows a line nearly parallel to the Pennsylvania R. R., and south of it to a point near Monmouth Junction; then deflects easterly, to avoid a trap-dyke, and passes down Lawrence Brook to Parson's Dam, and finally strikes the Raritan River at Sayresville. By this more favorable route the canal proper would be 31 4-10 miles long. The total distance from Philadelphia to the Ocean, near Sandy Hook, would be 78 miles, and to the Battery, in New York, 92 miles. By way of Cape May and the ocean these distances would be 260 and 274 miles, respectively.

The line is located in a topographical trough, or depression, extending across the state, as before mentioned, and the soil is generally sand, clay and gravel, with some red shales toward the eastern end insufficient in quantity to materially increase the cost of excavation.

Estimates are submitted for two sizes of canal prism. One is 96 ft. wide at bottom, 150 ft. wide at top and 20 ft. deep at the center, figured for vessels not exceeding 18 ft. in draft. The



Trestle Carrying Flume for Water Power Plant near Silverton, Colo.

other is 100 ft. wide at the bottom, 180 ft. wide at the surface and 28 ft. deep, for vessels of 26 ft. draft. Both canals are estimated for a 12-ft. berm on one side. One level is proposed from river to river at an elevation of 56 ft. above mean tide at Sandy Hook, or 60 ft. above low water in the Delaware River, near Bordentown. Both projects contemplate reaching this level by three locks of 20 ft. lift each, at either end of the canal. To economize water and time, the 20-ft. canal would have two sizes of locks side by side, and the 28-ft. canal three locks abreast. These locks would have the following dimensions:

No. 1.	205 ft.	by	24 ft.	with	10 ft.	on miter-sill.
No. 2.	340 ft.	"	44 ft.	"	20 ft.	"	"
No. 3.	500 ft.	"	65 ft.	"	28 ft.	"	"

These locks would be founded on piles, with timber grillage and floors, with masonry walls faced with ashlar and backed by rubble. The gates would be iron or steel of the most approved construction. An electric lighting plant would be established, with lights at locks and at each quarter-mile on the canal line.

Mr. Hutton estimates the total cost of the 20-ft. canal at $14,574,100, including right of way and 15% for contingencies. For the 28-ft. canal his estimate is $24,124,700. In these estimates the two locks for the 20-ft. canal figure at $2,930,000; and the third large lock for the 28-ft. canal would add $3,608,000 to this sum. The excavation on the two canals, at 20 cts. per yard for earth and 80 cts. for rock, would amount to $6,744,000 and $10,800,000, respectively.

The estimated water supply for the canal is about 500 cu. ft. per second, on the basis of a larger business than can be reasonably expected. As the extreme low-water flow of the Delaware River above the canal feeder at Point Pleasant is about 1,500 cu. ft. per second, the water supply is evidently beyond question.

Mr. Hutton bases his estimates of possible business upon the traffic of the Delaware & Raritan Canal in 1871, which was then over 3,000,000 tons annually. He assumes that, with the natural increase of the last 24 years, it is not unreasonable to expect a traffic of 5,000,000 tons per annum. He figures the operating expenses at $250,000 per year, or 5 cts. per ton on the above estimate. To pay 5% on the cost of a 20-ft. canal would add 15 cts. per ton, and to pay 5% on the cost of a 28-ft. canal would add 25 cts. These amount to total tolls of from 20 to 30 cts. per ton. If the ordinary coastwise trader is allowed an average speed of 10 miles per hour in the ocean, 7 miles in the approaches to the canal and 5 miles per hour in the canal, with 2 hours consumed at the locks, there would be saved by using the canal from 10½ to 11 hours on one trip between New York and Philadelphia. This statement, however, does not include possible delay by adverse winds and storms, nor does it take into account the fact that on the canal cheaper vessels might be used than on an ocean trip.

Mr. Hutton wisely concludes his report by pointing out that the ability to use this canal will depend entirely upon the necessary improvement and maintenance of the approaches by the national government; and until these essential preliminaries are arranged with the government, he says it is not advisable to invest any money in canal construction. The 27 miles of the Delaware River above Philadelphia have a depth of 26 ft. over less than seven miles; the other 20 miles would have to be deepened and maintained even for the shallower canal. No estimate of the cost of this Delaware River improvement is submitted, owing to lack of data, but Mr. Hutton states that it would possibly add $2,000,000 to the cost of the 20-ft. canal and $5,000,000 to that of the 28-ft. canal.

Professor Haupt, while agreeing in his estimates for construction with Mr. Hutton, takes a much more hopeful view of the situation. He figures a saving in time of 12.4 hours by the canal, and expects an annual commerce of not less than 7,000,000 tons soon after the opening, and 10,000,000 tons when the Delaware and Chesapeake ship canal is in operation. But he concludes his report by saying that it would be unquestionably better for all interests concerned if the United States government should make this a part of a 28-ft. free waterway between New York and Washington—and pay the bills.

LEGAL DECISIONS OF INTEREST TO ENGINEERS.

When Mandamus Will Not be Issued Against Municipal Officers.

The common council directed a committee to advertise for proposals for certain work, and to let it to the lowest bidder, and directed the mayor to execute the contract. After a party's proposal had been accepted, the council reconsidered its action, and indefinitely postponed the matter. The Supreme Court, 5th Dept., New York, held that a mandamus to compel the mayor to execute the contract would not lie, and that the remedy was an action against the city for damages.—Ryan v. Aldridge, Mayor, 31 N. Y. S. Rep., 920.

Terminal Agreement of Street Car Companies.

An agreement between two street railway companies "to erect, establish and maintain a joint railway depot and terminus" impliedly prohibits the extension by either company of its road beyond such depot.—Prospect Park & C. I. R. R. Co. v. Brooklyn, B. & W. E. R. R. Co. (Supr. Ct., 2d Dept.), 32 N. Y. S. Rep., 857.

Liability of Members of City Council.

Members of a city council are not subject to suit in either their official or individual capacity because they voted to repeal an ordinance conferring certain rights upon a corporation, when the repealing ordinance is based upon the fact that the corporation had failed to comply with the conditions imposed upon it.—Wimbish v. Hamilton (Supr. Ct., La.), 16 So. Rep., 856.

Right of Abutting Owner.

An abutting owner on a borough street on which a street railway company is constructing its electric line without any valid permission of the local authorities may enjoin the construction as a nuisance.—Thomas v. Inter-County St. Ry. Co. (Supr. Ct. of Pa.), 31 At. Rep., 476.

Duty to Protect Trolley Wire.

Whether a company operating an electric railway was negligent in not maintaining a guard over its

trolley wire, so as to prevent a falling telephone wire from resting on its trolley line and becoming charged with electricity, to the injury of one driving along the street, is a question of fact to be determined by the jury.—Block v. Milwaukee St. Ry. Co. (Supreme Ct. Wis.), 61 N. W. Reporter, 1101.

Fixing Price of Labor is Not Letting to Lowest Bidder.

The fixing by a board of water commissioners, in specifications for work to be done, of a minimum price to be paid for labor, and the awarding of a contract on the basis of such specifications, is a violation of a statutory provision requiring such work to be awarded to the lowest responsible bidder, and the letting is void.—Frame v. Felix (Supr. Ct., Pa.), 31 Atl. Rep., 375.

Damage for Change of Street Grade.

Where a grade crossing of a street and railway was changed by agreement of railway company and the city, the one raising its tracks and the other lowering the street, damages to one owning land adjoining the track by reason of increased cost of moving freight to and from cars on track cannot be collected of the city, as caused by change of grade.—In re, Tucker, etc. (Supreme Ct. Penn.), 31 At. Rep., 117.

Action on Paving Claim.

Where the laws of a state and the ordinances of a city provide that all passenger railway companies within such city shall be at the entire expense for paving, repaving, etc., necessary to a street occupied by them, the owner of a lot abutting on such street can set up the liability of such company as a defense in an action by the city against him.—Philadelphia v. Bowman, 31 At. Rep., 142.

HYDRAULIC SHIELD FOR THE BLACKWALL TUNNEL UNDER THE THAMES.

(With Inset.)

As most of our readers will recall, the largest submarine tunnel ever driven by hydraulic shields is now being constructed under the River Thames in London for the accommodation of vehicle and pedestrian traffic. A series of articles describing the work on this tunnel has recently appeared in our contemporary, "London Engineering," and we reprint on our inset sheet this week the drawings of the immense shield which is used in driving this tunnel.

This shield was made by Messrs. Easton & Anderson, of Erith; it is 19 ft. 6 ins. long over all, and is composed mainly of an outside shell made up of four ⅝-in. steel plates. It is circular in form, with an outside diameter of 27 ft. 8 ins. As shown in the illustrations on our inset sheet, the interior is divided by two vertical, air-tight diaphragms, permitting an excess of air-pressure to be used at the face over that employed in the tunnel proper, though so far there has been no necessity for this differential pressure. The space between the diaphragms forms an air-lock, and the doors in the plates are made tight by rubber facings. The material excavated is passed through these diaphragms by chutes, shown in Fig. 6, which are provided with doors, and also form air-locks.

The "tail" of the shield in the rear of the first diaphragm, is a built-up skin of plating extending back 6 ft. 3¼ ins. and covering the work of placing and lining the new permanent tunnel rings. In front of the diaphragms is another projecting ring forming the "cutting edge," shown in Fig. 1. Horizontally the shield is divided by three platforms, forming four working stages for the men, and three longitudinal vertical partitions cut the face of the shield into 12 compartments and also act as stiffeners. The total weight of the shield was 230 tons.

The size of the shield required some careful planning and engineering skill to get it into position. The shaft was first sunk to the requisite depth, and the shield itself was erected in a dock dug for this purpose near the head of the shaft, and the ends were then closed by wooden partitions so that the shield would float. A part of the caisson around the head of the shaft was then removed and water was admitted to the shaft and to the dock, and the shield was floated out until it was over the shaft. The caisson was then restored and the water pumped from the shaft, and as this was done the shield slowly sank to its proper position at the bottom of the shaft, ready for tunneling.

Returning again to the shield, it will be seen in Fig. 1 that about 6½ ft. back from the cutting edge there is a vertical screen depending from the top of each compartment. The space back of these screens and in front of the second diaphragm forms a safety chamber for the men in case of a sudden inrush of water from the face, due to a "blow-out" of air. The water would not rise to the top of these chambers, as it would be kept back by the air imprisoned in the closed upper space in each. When working in gravel, sliding iron shutters are pushed forward by means of screws to support the face after excavation, and the guides for these shutters are seen in Fig. 1.

The shield is moved forward by means of 28 hydraulic rams abutting against the completed portion of the tunnel lining. The heads of these rams are beveled off, so that they may bear upon the cast iron cylinder itself, and not upon the flanges, which might be broken off. Each ram is 8 ins. in diameter, and as the hydraulic pressure is equivalent to two tons per square inch, each ram can exert a thrust of about 100 tons, or 2,800 tons in all. This pressure has been exceeded at times when the pressure was raised to 2¾ tons per sq. in.

The cast iron lining segments forming the tunnel proper are erected inside the "tail" of the shield and bolted together in the usual manner, and as each ring is completed the shield is pushed forward by the hydraulic jacks. As each segment weighs about one ton, two hydraulic erectors are employed, which lift the segments and hold them in place until the bolts are put in. A somewhat similar method was used in the St. Clair tunnel, though without the hydraulic power.

The first permanent ring of the tunnel was put in place on June 9, 1893, on a down gradient of 1 in 36. At the beginning the face was in hard clay, excepting a 2-ft. layer of ballast at the top and about 1 ft. of sand in the bottom. In the first two months 125 ft. of tunnel was completed, or 50 rings. At this point the cutting-edge struck some hard substance and was bent up, but the shield was carefully pushed forward until 192 ft. of tunnel was finished. The damage to the shield was now so serious that steps had to be taken to relieve the damaged part from pressure. As it was impossible to withdraw the shield or repair it in position, it was necessary to push forward to the next shaft. To permit this, a bottom, timbered heading was driven 50 ft. in front of the bent part, and a concrete bed was laid in this of the same shape as the bottom of the shield. The shield was slid forward on this bed by the rams, and the bent parts were thus relieved of all work.

At this point the progress was about 5 ft. in 24 hours. But the sand now deepened, and as shaft No. 3 was approached the water increased in quantity. By the middle of December 477 ft. had been completed; the sand was up to the middle of the shield and the water was very troublesome. On Dec. 16 there was a heavy rush of water and sand into the advance heading, which soon filled up. The cutting-edge was then 67 ft. only from the caisson of Shaft No. 3, which was still being sunk with its cutting-edge still 4 ft. above the level of the tunnel heading. The back of the shield was timbered up, and the water rose to a height of 15 ft. behind it.

Work was now stopped on the tunnel until the shaft was sunk to its full depth, and the brick bulkhead, shown in Fig. 8, was built across the tunnel and provided with air-locks. Details of these locks and doors are shown in Fig. 9. On March 14 No. 3 caisson was finished, and on March 23 compressed air was let into the tunnel, and the trouble from water disappeared. Up to this time the driving had been done without compressed air. An airtight floor was put into Shaft No. 3 and the tunnel was driven into the shaft, reaching it early in May. The shield, once in the shaft, was accessible, and the necessary repairs were made by substituting steel castings for the plates cut away. These repairs were costly and required four months' time.

Since September, 1894, tunneling under the river has progressed only from the south side. Measured from center to center of shore shafts, the tunnel is 1,212 ft. long. In the first 700 ft. of this distance the progress was rapid and the work easy, the soil being a fairly favorable loamy sand and clay. At the end of the 700 ft. ballast was met with in direct communication with the river water. The compressed air began to escape rapidly, requiring all the compressors to be put to work to increase the air supply. To prevent this escape of air, an artificial bed of clay was thrown down from hopper-barges, making a layer 10 ft. deep over the river-bed and extending 75 ft. each side of the tunnel line. At this point there was but 5 ft. of ordinary river ballast over the top of the shield, and the clay served an excellent purpose in preventing the escape of air. At the time of writing the article in "Engineering," 870 ft. out of the total 1,212 ft. of river tunnel were completed.

This work is being carried out under the orders of the London County Council, with Mr. A. R. Binnie, M. Inst. C. E., as Chief Engineer for the Council. The resident engineers are Messrs. David Hay and Maurice Fitzmaurice, M. Inst. C. E., and the contractors are Messrs. Pearson & Sons, the same firm that did the last work on the Hudson River tunnel.

FORMULAS FOR LONG COLUMNS.

By A. J. Du Bois,* M. Am. Soc. C. E.

A number of rational formulas for long struts have been proposed and several are in common use. The object of the present paper is to present a new rational formula which includes all the others as special cases. By "rational" formula we mean one which contains no empirical constants and which is the logical result of mathematical discussion based upon the accepted theory of flexure.

Euler's Formula.—The well-known "Euler's formula" for long struts is

$$\frac{W}{A} = \frac{n^2 \pi^2 E k^2}{l^2} \qquad (E)$$

where W is the "crippling load," A the area of cross-section, and hence $\frac{W}{A}$ is the "crippling unit stress," E is the coefficient of elasticity of the material, l the length, k the radius of gyration of the cross-section for the axis through the center of mass at right angles to the plane of bending, and n a number depending upon the end conditions.

The theoretic values of n are n= 1, for round ends without friction; n = 2 for one end round without friction and the other end fixed; n = $\frac{3}{2}$ for both ends fixed.

Practical Values of n.—In practice we have two pin ends with friction, or one pin end with friction and one flat end or two flat ends. A flat end is not perfectly "fixed." Hence the practical values of n are different from the theoretic values just given.

The result of comparison with many experiments shows that Euler's formula gives the crippling unit stress $\frac{W}{A}$ with all desirable accuracy for very long struts—i. e., when $\frac{l}{k}$ is very great, if we take for n the values

	Two pin ends.	One pin, One flat end.	Two flat ends.
n =	$\sqrt{\frac{5}{3}}$	$\frac{5}{2\sqrt{3}}$	$\sqrt{\frac{5}{2}}$

This has been thoroughly established by the now classic paper of Mr. Thomas H. Johnston, M. Am. Soc. C. E. (Trans. Am. Soc. C. E., July, 1886).

Assumptions of Euler's Formula.—Euler's formula is a strict mathematical deduction based upon two assumptions: (1) the strut is assumed to be subjected to flexure only, thus ignoring the lateral dimensions and the effect of the direct compression; (2) it is assumed that the elastic limit is not exceeded, and therefore the ordinary theory of flexure can be applied. How, then, does it come about that this formula gives for very long struts the value of the crippling unit stress with such accuracy?

Evidently, as $\frac{l}{k}$ increases, the effect of flexure as compared with that of the direct compression increases also. Experiment then justifies the conclusion that when $\frac{l}{k}$ is large, the effect of the di-

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rect compression can be practically neglected. The first assumption of flexure only is thus, in such case, justified by experiment. As to the second assumption, such tough, fibrous materials as wrought iron, steel, etc., are more or less semi-plastic under compression, and fail by slow flowing. The crippling load then for such materials is that which causes in the most compressed fiber a unit stress equal to the elastic limit unit stress. For a greater stress slow flowing begins. In such cases, then, the elastic unit limit stress S_e should be regarded as the ultimate strength.

Mr. Johnson, in the paper quoted, found that the unit stress in the most compressed fiber was "by no means so great as the compressive resistance shown by short prisms," and directs attention to this fact. Mr. Chas. A. Marshall, M. Am. Soc. C. E. (Trans. Am. Soc. C. E., August, 1881), states as the result of his experiments that "the elastic limit of the material is the chief factor in determining the ultimate resistance of struts of ordinary length made out of wrought iron or steel, excepting the very hardest kinds, and that the two quantities—elastic limit in compression and ultimate compressive strength—are identical within a considerable range of length-ratio of columns."

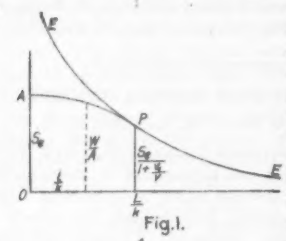

Fig. 1.

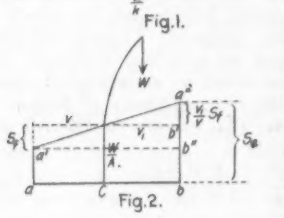

Fig. 2.

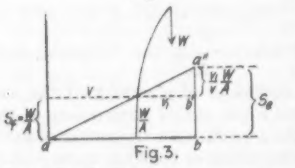

Fig. 3.

The second assumption of Euler's formula, that the elastic limit is not exceeded, is thus justified by theory and confirmed by experiment. Hence we find that Euler's formula in the case of long struts actually gives with accuracy the crippling unit stress, because in such case both its assumptions are in practical accord with fact.

Limitation of Euler's Formula.—If, then, we had to do only with very long struts, Euler's formula, with the practical values of n already given, would be quite satisfactory.

But we find that for those values of $\frac{l}{k}$ which ordinarily occur in practice Euler's formula gives values of $\frac{W}{A}$ too large—for short struts, very much too large. Thus, for the extreme case of $\frac{l}{k} = o$, Euler's formula gives $\frac{W}{A}$ infinity, whereas it ought to be, as we have seen, equal to S_e. If we take $x = \frac{l}{k}$ as abscissa, and $y = \frac{W}{A}$ as ordinate (Fig. 1), we shall find, then, that the curve E P E of Euler's formula, with the practical values of n already given, agrees well with experiment for $\frac{l}{k}$ large, but gives $\frac{W}{A}$ too great when $\frac{l}{k}$ is small. At some point P corresponding to $x = \frac{L}{k}$ it must cease to apply.

Hence it is that various formulas have been proposed to fill up the gap A P in Fig. 1, such as the "straight line formula," the "parabola formula," the "Rankine-Gordon formula," etc.

The question arises then, Can any limit $\frac{L}{k}$ be deduced which gives the point P within which Euler's formula cannot be used?

Limiting Length for Euler's Formula.—Let a b (Fig. 2) represent the cross-section A, and C the center of mass of this cross-section.

Let v and v_1 be the distances in the plane of bending of the most remote fibers a a', b b' from C on the convex and concave sides, respectively. For symmetric cross-sections we have $v = v_1$.

Let S_e be the elastic limit unit stress, and S_f the unit stress due to flexure in the most remote fiber, a a', on the convex side. If there were no flexure we would have a uniform unit stress of direct compression, $\frac{W}{A}$, at every point of the cross-section. On the convex side this unit stress for the most remote fiber, a a', is diminished by the unit stress S_f due to flexure, and on the concave side, for the most remote fiber, b b', it is increased by $\frac{v_1}{v} S_f$. We have then remaining a uniform unit stress of direct compression at every point of the cross-section represented in the figure by a a', which we can write:

$$a\,a' = \frac{W}{A} - S_f \qquad (a)$$

This direct compression is ignored by Euler's formula. On the convex side we have in addition to this direct compression a unit stress due to flexure represented in the figure b'' a'', which we can write:

$$b''\,a'' = S_f + \frac{v_1}{v} S_f \qquad (b)$$

Now, as long as the length, l, of the strut is less than a certain limiting length, L, we see from Fig. 2 that when $\frac{W}{A} + \frac{v_1}{v} S_f$ on the concave side is equal to the elastic limit S_e, we shall have S_f on the convex side less than $\frac{W}{A}$, and from equation (a) there will be direct compression at every point of the cross-section. So long as this is the case we cannot apply Euler's formula, which ignores this direct compression.

Now, let l be increased and W decreased until we have such a length L of strut (Fig. 3) that when the unit stress on b b' is equal to the elastic limit S_e, we shall have S_f just equal to $\frac{W}{A}$. When this is the case we see from equation (a) that there is no direct compression a a', and Euler's formula applies. For any length greater than L we shall have, when the unit stress at b is equal to the elastic limit S_e, true flexure, or tension on one side and compression on the other. This length, L, then gives a distinct point of demarcation between the case of flexure with direct compression, and that in which we have to do with flexure only.

We have for this length from equation (b) making $S_f = \frac{W}{A}$ and $b''\,a'' = S_e$

$$\frac{W}{A} + \frac{v_1}{v}\frac{W}{A} = S_e \text{ or } \frac{W}{A} = \frac{S_e}{1 + \frac{v_1}{v}}$$

But from Euler's formula we have also for the limiting length L

$$\frac{W}{A} = \frac{n^2 \pi^2 E k^2}{L^2}$$

Equating these two values of $\frac{W}{A}$ we have for the limiting length for Euler's formula

$$L = \frac{n k \pi \sqrt{\left(1 + \frac{v_1}{v}\right) E}}{\sqrt{S_e}} \qquad (L)$$

For values of l greater than L, Euler's formula applies. It remains to find a formula for the curve A P in Fig. 1, when l is less than L.

A New Formula for Long Struts.—We take, then, in Fig. 1, the abscissa

$$\frac{L}{k} = \frac{n \pi \sqrt{\left(1 + \frac{v_1}{v}\right) E}}{\sqrt{S_e}}$$

and we have for the corresponding ordinate at the point P

$$\frac{W}{A} = \frac{S_e}{1 + \frac{v_1}{v}}$$

Beyond this point Euler's formula can be used. It remains to bridge over the gap A P for values of $\frac{l}{k}$ less than $\frac{L}{k}$.

There is undoubtedly some curve, A P (Fig. 1), which is the true curve for an ideal strut; that is, one perfectly straight, perfectly homogeneous, the load W perfectly centered, etc. No strut, however, is thus ideally perfect, and hence even if we knew the true curve A P, the values of $\frac{W}{A}$ given by experiment, would be found scattered above and below it over a considerable range. Evidently, then, the true curve would have no practical advantage over any convenient curve which passes through A and P, so that O A $= S_e$ for $l = o$ and $y = \frac{S_e}{1 + \frac{v_1}{v}}$ for $l = L$, and has at P a common tangent with Euler's curve P E. Hence the numerous formulas which have been proposed, all of which are valuable. One common defect of all these formulas is that they ignore the lateral dimensions v and v_1. We are now, however, in a position to deduce a more general formula, which does not ignore these dimensions, and which shall be entirely rational—i. e., without empirical constants.

Let us assume for the curve A P, the equation

$$y = S_e + b\,x + c\,x^2 \qquad (1)$$

This curve passes through A so that O A (Fig. 1) equals S_e for $l = o$. It remains to determine b and c so that the curve shall pass through P and have a common tangent at P with Euler's curve

$$y = \frac{n^2 \pi^2 E}{x^2} \qquad (2)$$

If we make $x = \frac{L}{k}$ in (1) and (2) and equate, we have for the condition that the curve passes through P

$$S_e + \frac{b\,L}{k} + \frac{c\,L^2}{k^2} = \frac{n^2 \pi^2 E k^2}{L^2} \qquad (3)$$

If we differentiate (1) and (2), and equate $\frac{dy}{dx}$ in both cases for $x = \frac{L}{k}$, we have for the condition of a common tangent at P

$$b + 2c\,\frac{L}{k} = -\frac{2 n^2 \pi^2 E k^2}{L^2} \qquad (4)$$

From (3) and (4) we find

$$b = -\frac{2 S_e k}{L} + \frac{4 n^2 \pi^2 E k^2}{L^3}$$

$$c = \frac{S_e k^2}{L^2} - \frac{3 n^2 \pi^2 E k^4}{L^4}$$

Substituting in (1) and putting $x = \frac{l}{k}$ and $y = \frac{W}{A}$, we obtain for the crippling unit stress for all values of l less than L.

$$\frac{W}{A} = S_e \left[1 + \frac{2 (v - v_1)\, l}{(v + v_1)\, L} - \frac{(2 v - v_1)\, l^2}{(v + v_1)\, L^2}\right]$$

where L is given by

$$L = \frac{n \pi k \sqrt{\left(1 + \frac{v_1}{v}\right) E}}{\sqrt{S_e}} \qquad (5)$$

We call this formula the "S P R" formula, because the well-known "straight line," "parabola" and "Rankine" formulas are special cases of it, and it includes them all.

Thus, if $v_1 = 2\,v$, the third term in the parenthesis disappears, and the equation becomes the well-known "straight line" formula, identical in every respect with that given by Mr. Thos. H. Johnson in his paper already quoted. This would be the case of an ideal strut of triangular area. But imperfect homogeneity and centering, and other imperfections may well cause the same formula to apply practically to a symmetric cross-section also.

We see also that for a given area, A, the crippling unit stress is a maximum for $v_1 = 2\,v$. Do we not find here a corroboration of our formula in the familiar cross-section of the English "long bow," which seems to have been so shaped by generations of archers, that for any practicable plane of bending $v_1 = 2\,v$?

If $v = v_1$ the second term in the parenthesis disappears, and we obtain the "parabola formula" precisely as given by Prof. J. B. Johnson ("Modern Framed Structures"). This is the case of ideal symmetric cross-section.

Again, since $\frac{v - v_1}{v + v_1}$ and $\frac{2\,v - v_1}{v + v_1}$ are generally small fractions, if we neglect higher powers, we can write the "S P R" formula in the approximate form

$$\frac{W}{A} = \frac{Se}{1 - \frac{2\,(v - v_1)\,l}{(v + v_1)L} + \frac{(2\,v - v_1)\,l^2}{(v + v_1)\,L^2}} \qquad (6)$$

If in this we make $v = v_1$ we obtain

$$\frac{W}{A} = \frac{Se}{1 + \frac{Se\,l^2}{4\,n^2\,\pi^2\,E\,k^2}} \qquad (7)$$

This is the literal form of the Rankine-Gordon formula, which simply puts "ultimate strength" in place of Se in the numerator, and an empirical constant in place of $\frac{Se}{4\,n^2\,\pi^2\,E}$ in the denominator.

We see, then, that the Rankine-Gordon formula is a special case of our "S P R" formula; also that it applies only to symmetric cross-sections, and is, according to our formula, an approximate form only. We also see upon what quantities the empirical constant depends.

Here again our formula is corroborated, for if we accept Euler's formula

$$y = \frac{n^2\,\pi^2\,E}{x^2}$$

as a true rational form, and also accept the Rankine-Gordon formula

$$y = \frac{Se}{1 + c\,x^2}$$

as also a true rational form, differentiate each and equate the values of $\frac{dy}{dx}$, we find $c = \frac{Se}{n^2\,\pi^2\,E}$ and x = infinity. In other words, the point of tangency of the two curves is at an infinite distance, a result which clearly shows that the two forms are incompatible, and cannot both be truly rational. If we assume the Rankine-Gordon form as truly rational, we practically eliminate Euler's. To retain one is to reject the other. Our "S P R" formula is thus corroborated in its conclusion that the Rankine-Gordon form is only approximate.

Equation (7) is also the identical formula of Professor Merriman (Engineering News, July 19, 1894), if we omit the 4 in the denominator. With the same omission it is also the formula of Mr. John D. Crehore, C. E. ("Mechanics of the Girder"), if we put "ultimate strength" in place of Se.

Both these formulas are claimed as rational. They are both special cases of the "S P R" formula, both are shown by it to assume symmetric cross-section, and to be only approximate in form. In common with all formulas heretofore, they ignore lateral dimensions.

Professor Merriman derives his formula precisely as we have indicated. He assumes both Euler's formula and also the Rankine-Gordon form as truly rational. He then finds the point of tangency to be at an infinite distance, and retains the Rankine-Gordon form with $c = \frac{Se}{n^2\,\pi^2\,E}$. He thus is forced to drop out of sight one of the formulas he started by assuming, and has to take the Rankine-Gordon form as covering the entire range. That is, he concludes, that the Euler formula is only correct at an infinite distance. As we have seen, this really shows incompatibility of the two forms, a fact with which our formula agrees. He concludes that there is "no distinct line of demarcation between the case of pure compression and that in which lateral flexure begins to have a slight influence." This conclusion is inevitable, because such a line of demarcation depends upon lateral dimensions, and the influence of these is not contained in either of his assumed equations. We thus have the contradictory result of two forms, both assumed as truly rational, mutually excluding each other. Our formula unifies both. As is clearly shown by Fig. 3, if we take into account v and v_1, there is a definite length beyond which, when the fiber stress reaches Se, direct compression ceases, and we have to do with flexure. This length cannot evidently be deduced from combination of Euler's and Rankine's formulas, for they do not contain the data on which it depends.

If, then, the "S P R" formula here given takes into account lateral dimensions, unifies and includes all the others as special cases, and points out their limits of application, may we not consider it as more general, and therefore preferable to the others?

Since in nearly all practical cases we have to do with symmetric cross-sections, where $v = v_1$, our formula becomes for such case simply

$$\frac{W}{A} = Se\left[1 - \frac{Se\,l^2}{4\,n^2\,\pi^2\,E\,k^2}\right] \qquad (8)$$

for values of $\frac{l}{k}$ less than

$$\frac{L}{k} = n\,\pi\sqrt{\frac{2\,E}{Se}} \qquad (9)$$

while for greater values of $\frac{l}{k}$, we have Euler's formula

$$\frac{W}{A} = \frac{n^2\,\pi^2\,E\,k^2}{l^2} \qquad (10)$$

These formulas, as we have stated, are identical with those given by Prof. J. B. Johnson in "Modern Framed Structures." They simply appear here as special cases of our more general formula. They are more convenient of application than the Rankine-Gordon form or Professor Merriman's modification of it, and quite as convenient as the "straight line" formula of Mr. Thos. H. Johnson, and they would appear from our discussion to be nearer the true curve for symmetric sections than the latter.

The foregoing remarks are made in no sense derogatory to the practical value either of the "straight line" or of Professor Merriman's formula. As we have already conceded, any curve between A and P (Fig. 1), which satisfies the conditions, cannot fail to be practically satisfactory. The straight line tangent at P cuts off a distance, O A, somewhat greater than Se though less than the "ultimate strength," as its author pointed out, and therefore fails to perfectly satisfy the conditions. It is none the less valuable, reliable and easy of application.

So also of Professor Merriman's formula. Its deviation from the others is practically insignificant, while for large values of $\frac{l}{k}$ it coincides sufficiently well with Euler's curve, and Professor Merriman has therefore covered in a single rational formula the entire range. This must be considered an advance on the Rankine-Gordon formula, with its empirical constants and its adoption of "ultimate strength" in place of elastic limit. In the words of its author: "If it should not be thought wholly satisfactory from every theoretical point of view, it may prove a step toward the desired consummation."

In the same hope we present the "S P R" formula, which, while including all the others as special cases, does so by virtue of taking into account for the first time the hitherto neglected lateral dimensions.

SPECIFICATIONS FOR ELECTRIC LIGHT FRANCHISE, HEMPSTEAD, N. Y.

Just how to draw a contract between a town and an electric lighting company so as to protect the interests of all concerned is a somewhat difficult matter in the present state of public opinion and legislative provisions. The Trustees of Hempstead, N. Y., have invited proposals for lighting that Long Island village for five years. The specifications, on which bids will be received Sept. 2, contain a number of points of interest. Three sets of bids are requested for street lighting on the basis of either 25 arc and 100 incandescent, 150 incandescent, or 70 arc lamps, the arc lamps to be of not less than 800 and incandescent of not less than 50 c. p., and all lamps to burn every night in the year from sunset to sunrise at the full stipulated candle power. The village may choose any one of the three plans which it may see fit and may order as many more lamps as it desires at the same price or prices. The charges for private lighting must not be more than 15% above those for public lighting, and all private service will be subject to the rules and regulations of the village trustees. The plant must be completed by Dec. 15, 1895. Payments for street lighting will be made monthly. A bond of $5,000 is required to guarantee faithful performance of the contract. Mr. B. Valentine Clowes is President of the Village Trustees.

The remaining provisions of the specifications, with the omission of some repetitions and general clauses calling for good workmanship and service, are as follows:

The poles shall be straight, smooth, of sound material, not less than 6 ins. in diameter at the top; they shall be firmly set and maintained in the ground, and shall be kept well painted, so as not to be unsightly. All poles supporting lights shall be at least 35 ft. in height from the ground grade of the street, and all other poles (except those supporting incandescent lights where the wires do not cross a street or avenue, and such incandescent lights are not suspended near or midway across a street or streets) shall be at least 30 ft. in height from the street grade. Such poles as support incandescent lights not suspended over, or the wires cross a street, shall be not less the 25 ft. in height above the grade of the street.

The wires are to be strung taut, and to be kept taut at all times, and not allowed at any time to unnecessarily sag down at any point, and are always to be kept at least as high as 20 ft. from the ground, and are always to be kept properly insulated at all points or parts where insulation is proper and necessary to prevent accident or danger to any of the inhabitants of, or property, in said village.

The street lights are to be suspended over the center of the street or streets at such points and places as the Board of Trustees of the village may designate. No arc or incandescent light suspended over a street shall be set or maintained at a lower elevation than 18 ft. above the level of the street, unless expressly so ordered by the Board of Trustees of said village.

The work of setting, erecting, and maintaining the poles, wires and lights shall be done by the company, person or persons contracting, under the supervision and direction, and to the satisfaction and approval of the Board of Trustees of the village, and such company, person, or persons contracting, shall at all times comply in regard thereto with all reasonable rules and regulations.

If all or any of the said street lights shall go out or cease to burn, or cease to be of full herein stipulated candle power for the period of one night or longer, unavoidable accidents or damage by the elements excepted, said company, person or persons contracting shall forfeit to said village of Hempstead double the price of such light or lights for the period it or they shall fail to burn or be diminished in candle power, the amount so forfeited to be deducted from the first payment to be thereafter made to such contractor under the contract; but this provision shall not prevent the village from taking any other legal or equitable proceedings or estop it from asserting any claim, legal or equitable, against such company, person or persons contracting, upon such failure.

Such company, person or persons contracting, shall indemnify and save harmless said village of Hempstead from all claims and demands, liabilities, suits, damages, or costs, arising out of or suffered or incurred by reason of the construction or maintenance of said electric light plant and apparatus, poles, wires and lights or arising out of, suffered or incurred by reason of any negligence, want of skill or improper or unlawful act of or by such company, person or persons, its, his, or their servant or employee in respect thereto.

CHICAGO MAIN DRAINAGE CHANNEL. XIV.

Section 7, Lemont Division.

This section was one of the group originally in the hands of Agnew & Co., and like the others it was assigned by that firm to the present contractors. The assignment was made April 20, 1894, and the assignees were Mason, Hoge & Co. The work is actually being done by subsidiary companies organized by members of Mason, Hoge & Co. These contractors received the work greatly in arrears in its progress requirements, but have gradually cut the deficiency down to a nominal amount. According to the latest revised estimates, there are on the section 282,485 cu. yds. of glacial drift excavation at 26 cts. per cu. yd.; 931,307 cu. yds. of solid rock excavation at 74½ cts. per cu. yd., and 3,037 cu. yds. of retaining wall at $3.25 per cu. yd.

As was stated in the description of Section 6, a portion of the east half of the main channel on Section 7 occupied the old bed of the Desplaines

River, and when the present contractors assumed the work, they assumed a contract with Charles Vivian & Co. for removing the muck of the old river bed with a hydraulic dredge. The sides of this dredge excavation had to be supported by a revetment of hard material, and the levee between the main and river diversion channels had to be riprapped, as has been described on Section 6. Altogether there were 4,529 cu. yds. of revetment and 4,390 cu. yds. of riprap on Section 7, costing 65 cts. and 63 cts. per cu. yd., respectively.

After removing the muck there remained only a few feet of glacial drift overlying the rock, and this was removed by dump cars and carts hauled by teams. There was nothing unusual in this part of the work, and it need not be mentioned further. The plant for rock excavation is, however, worthy of more than ordinary mention. Besides the familiar cableway there are two cantilever conveyors and two high-power revolving derricks used on the rock work. The work of these machines will be taken up in the order named.

As the construction of the Lidgerwood traveling cableway has already been described, only the method of operation and efficiency will be considered here. It works on a face extending transversely across the channel, which is broken down by drilling rows of holes parallel with the face and blasting. About 0.75 lb. of explosive is used per cu. yd. of rock. Nine skips and about 35 men are worked on the face. The wages paid are:

Cableway engineer	27½ cts. per hr.
" fireman	16½ " " "
" signalmen	10 to 15 cts. per hr.
Foreman on face	$3 per day.
Laborers " "	15 cts. per hr.

About 1½ tons of coal, costing $2 per ton, is burned each shift, and the cost of oil and waste is about 25 cts. per shift.

According to the reports of the Superintendent of Construction the average output of this cableway per 10-hour shift since work was begun with it has been 332 cu. yds. A report of the same machine's work obtained from the contractors and covering four months shows the following results:

Month.	Total No. skips loaded.	Total cu. yds. excavated.	Total delay, hours.	Tot'l No. 10-hr. shifts worked.
Dec., 1894	4,424	8,017	No. rec.	No. rec.
Jan., 1895	4,187	8,619	33	25*
Feb., 1895	4,259	7,661	28	23
Mar., 1895	7,039	11,097	14	24

* These were nine-hour shifts.

The delays noted are the aggregates of from five to twenty-minute waits for small repairs or for the buckets to be loaded, during which time the men are under pay. The average delay per 10-hour shift was 1.32 hours in January, 1.22 hours in February and 0.58 hour in March. For the three months the average delay per 10-hour shift was 1.08 hours. If the total number of shifts given above be divided into the total amount of excavation the average output per 10 hours for three months is found to be 393.9 cu. yds. Assuming that the average number of men (laborers and foremen) worked on the face was 35, then the amount of rock handled per man per 10-hour shift for three months was 10.14 cu. yds. The average skipload for the same time was 1.87 cu. yds.

The second method mentioned for excavating rock is the cantilever conveyor, or Hulett-McMyler conveyor, as is known on the canal. A general elevation of this machine is shown in Fig. 65, and from this the method of construction can be easily seen. A metal framework tower is mounted on eight pairs of standard gage car wheels, and carries two cantilever arms, one of which extends upward over the spoil bank and the other downward over the channel excavation. A trolley or carriage travels along a track on the plane of the lower chord of the cantilevers, and has a fall block suspended from it, which carries the skip. Referring to the illustration, Fig. 65, it will be seen that the fall block and attached skip are hauled vertically to the carriage, to which it is locked automatically, and then the carriage and skip are moved along the track until they overhang the spoil bank, when the skip is automatically dumped. The carriage is held at any point desired by the holding rope, whose function and operation are plainly shown by the drawing. The carriage and fall block are operated by a 9 × 12-in. hoisting engine, working under 80 lbs. steam pressure and making 200 revolutions per minute.

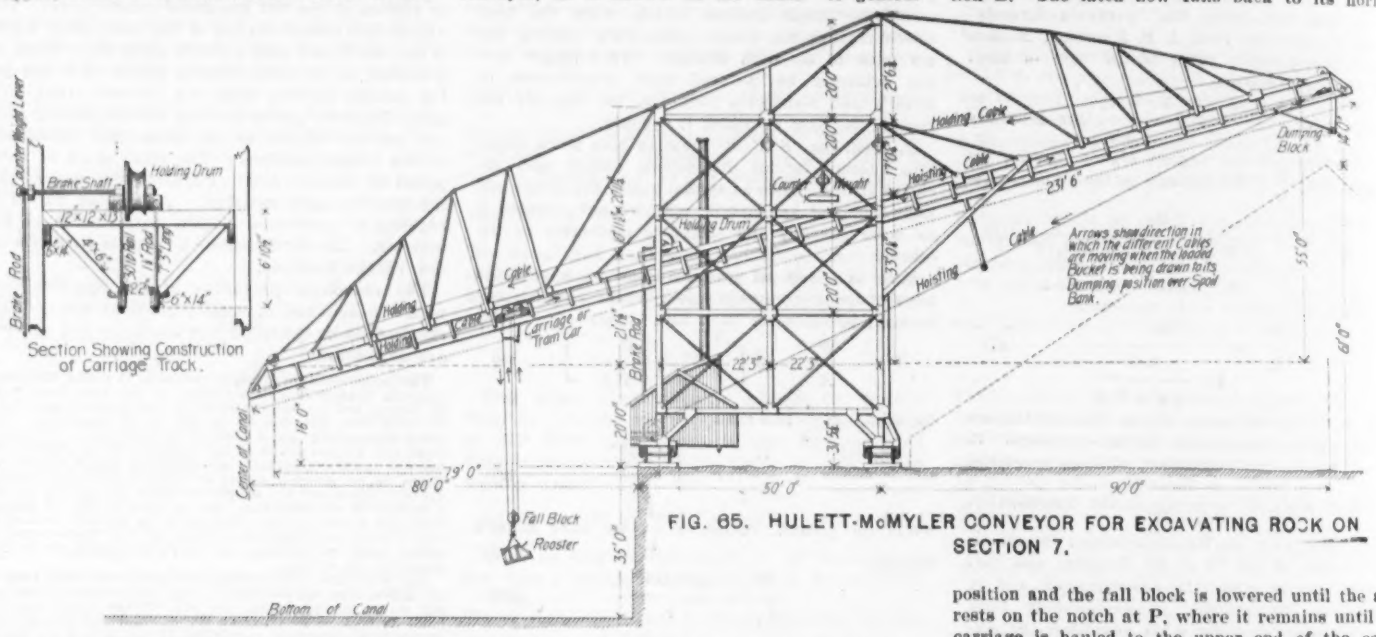

FIG. 65. HULETT-McMYLER CONVEYOR FOR EXCAVATING ROCK ON SECTION 7.

The only features about this conveyor which need especial explanation are the automatic locking device in the carriage and the automatic dumping device. Fig. 66 is a sectional elevation of the carriage. The cast steel latch, A, is shown in its normal position by the full lines. When the fall block with the bucket attached is hoisted from the pit the axle strikes the lower inclined face of the latch and forces it into the position shown by the broken lines, allowing the axle to pass to the position B. The latch now falls back to its normal position and the fall block is lowered until the axle rests on the notch at P, where it remains until the carriage is hauled to the upper end of the cantilever, dumped, and returned to its position over the pit. The next move is to lower the fall block and skip to the bottom of the pit. First the fall block is hoisted so that the axle strikes the latch and forces it to the position shown by the broken lines. When the axle reaches the position R the latch returns to its normal position. The fall block is then lowered, the axle passing along the line KK, until the skip rests on the bottom of the pit. The line J J shows the route of the axle when entering the carriage.

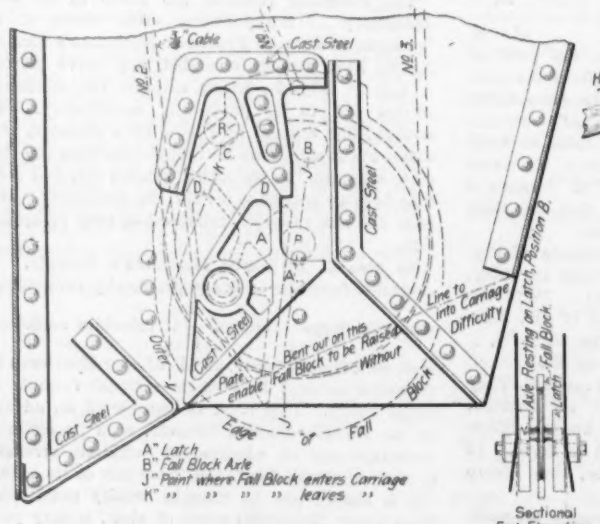

Fig. 66. Sectional Elevation of Carriage for Hulett-McMyler Conveyor.

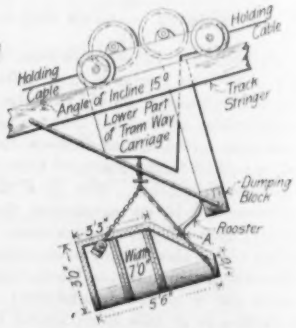

Fig. 67. Automatic Dumping Device for Hulett-McMyler Conveyor.

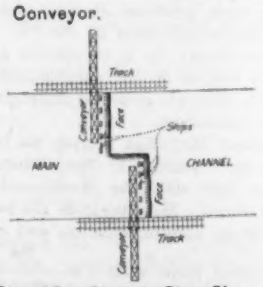

Fig. 68. Sketch Plan Showing Arrangement of Hulett-McMyler Conveyors for Excavating Rock.

The arrangement for automatically dumping the skip is shown by Fig. 67 and is very simple. The carriage is drawn up the cantilever until the "rooster" strikes the dumping block and is forced back, releasing the hook A. This allows the open end of the skip to drop and the load to spill out. It

will be seen that the bucket may be dumped at any point on the conveyor by simply placing the dumping block at that point. The skip is of steel, and has a capacity of 3.7 cu. yds. water measure, or 1⅝ cu. yds. of rock in place. This last figure is calculated from the engineer's estimates of excavation done, and the number of skip loads covered by

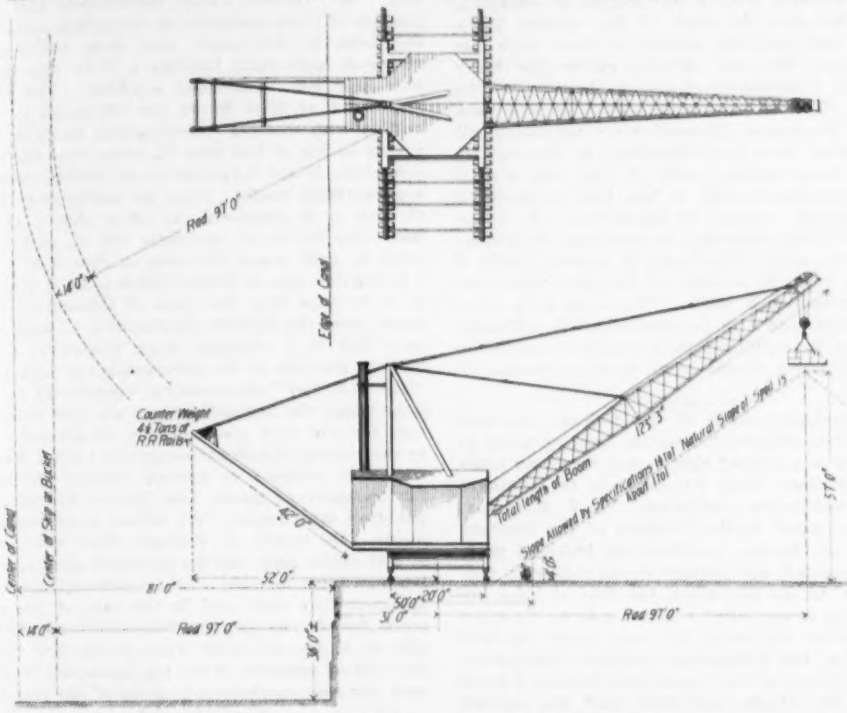

FIG. 69. HULETT-McMYLER SINGLE BOOM TRAVELING DERRICKS FOR HANDLING ROCK ON SECTION 7.

that quantity. The total weight of the conveyor is 110 tons, and its cost is between $7,500 and $10,000.

Two of these conveyors are used on Section 7, one on each side of the canal, and they are placed nearly opposite each other. Fig. 68 is a sketch plan showing the arrangement. Each conveyor works a face one-half the width of the channel, with five skips and from 25 to 30 men in the pit. Three of these men attach the skips to the fall block and the others load the skips. Two men—an engineer and fireman—are required to operate each conveyor, and these men receive $2.50 and $1.50 per 10-hour day, respectively. The other expenses of operating each conveyor per 10-hour shift are approximately as follows: Services of machinist, $1; superintendence, 75 cts.; coal, 1¼ tons, $2.20; oil, water and waste, 25 cts.; repairs, 50 cts.; maintenance of track, $1.50; services of night watchman, 50 cts.; making a total of $10.70 per 10-hour day. It is not easy to get exact figures of expenses, but these have been carefully verified wherever possible, and are believed to be approximately accurate as far as they go. The amount of rock taken out by these conveyors, of course, varies from day to day, but according to the reports of the Superintendent of Construction the average amount per 10-hour shift since the two conveyors have been at work on Section 7 is 190 cu. yds. This record extends over several months' time. The highest daily record made up to Feb. 15, 1895, was 367 cu. yds. These figures, it will be understood, indicate the capacity of the men loading the skips rather than the capacity of the conveyor to handle the loaded skips, but they are the figures which interest the contractor. What the conveyor might do if the skips were loaded as fast as it could handle them is another thing.

The conveyors just described were built by the Hulett-McMyler Mfg. Co., of Cleveland, O., as were also the two high-power derricks on Section 7. An elevation and plan of one of the Hulett-McMyler derricks are shown in Fig. 69, and the other is identically the same in construction and operation. The derrick has a single boom 123¼ ft. long, properly counterbalanced and mounted on a turntable, the whole being carried by a 20-ft. gage car. The extreme radius of swing of the bucket is 97 ft. This derrick has the longest boom of any single-boom self-contained derrick* on the canal, and, so far as we know of, any ever used anywhere.

The manner of bracing the boom to the turntable is clearly shown by the drawings. All movements, both turning, traveling and hoisting, are controlled by four levers. It is stated that the derrick will swing its skip from the pit to the spoil bank, dump the load, and return to the pit in 45 seconds. The rate of travel along the track is 400 ft. per minute. The skip is of steel and has a capacity of 4 cu. yds. water measure, or of 1⅝ cu. yds. of rock in place. The total weight of the skip is 2,400 lbs., and of the full load, 1⅝ cu. yds., 3½ tons. The safe working load of the machine is 10,000 lbs.

The method of operation is to place one derrick on each side of the channel, nearly opposite the other. In this position each derrick takes out one-half the rock. Three men—a cranesman, fireman and a man to trip the skips—are required to operate each derrick. The two derricks operate a face clear across the channel, with 12 skips, 2 foremen and 50 laborers. Six laborers, or three for each derrick, attach and detach the skips. The skip is dumped by an ordinary rope trip. According to figures collected by Mr. Wm. M. Christie, while on the Division Engineer's staff at Lemont, the total cost of operating one of these derricks, including wages, coal, oil and waste, repairs, etc., is $10 per 10-hour shift. About one ton of coal is burned by each derrick each shift. The total weight of the derrick is 95 tons, and the total cost about $15,000.

Figures taken from the reports of the Superintendent of Construction show the output of these derricks since they began work to be 219 cu. yds. per 10-hour shift each. It is stated that the two derricks together have taken out as much as 894 cu. yds. per 10-hour shift. These quantities are rock in place. Fig. 70 is a view showing one conveyor and one derrick at work on the channel.

Turning now to some of the general features of the rock work; considerable rock on the top was taken out with dump cars. These were loaded by hand and hauled by team to the bottoms of the inclines, up which they were drawn by hoisting engines, and then hauled by team to the dumping ground. This rock was used to grade tracks for the conveyors, derricks and cableways, and for riprap. Seventy-seven thousand two hundred cu. yds. of rock suitable for dimension stone have been quarried by the plug and feather method, an extra of $1 per cu. yd. being allowed to the contractor for the work of quarrying and storing the stone. The stone is stored on the bank of the main channel, and it is expected that it will be used in bridge piers or retaining walls on other sections. Most of the retaining wall on this section was built to bring the sides of the channel up to grade, the top layer of rock being rotten, and to fill in pockets of soft rock.

Sullivan steam channelers, manufactured by the Sullivan Machinery Co., of Chicago, Ill., are used, and both Ingersoll-Sergeant and Rand air drills. These receive their air from a 20 × 30-in. duplex Rand compressor, which forces the air into a 4 ft. × 5-ft. cylindrical receiver, from which it enters the pipe line running along the canal berm. This pipe reduces from 8 ins. in diameter at the receiver to 7 ins., 6 ins., 4 ins. and 3 ins., and has 2½-

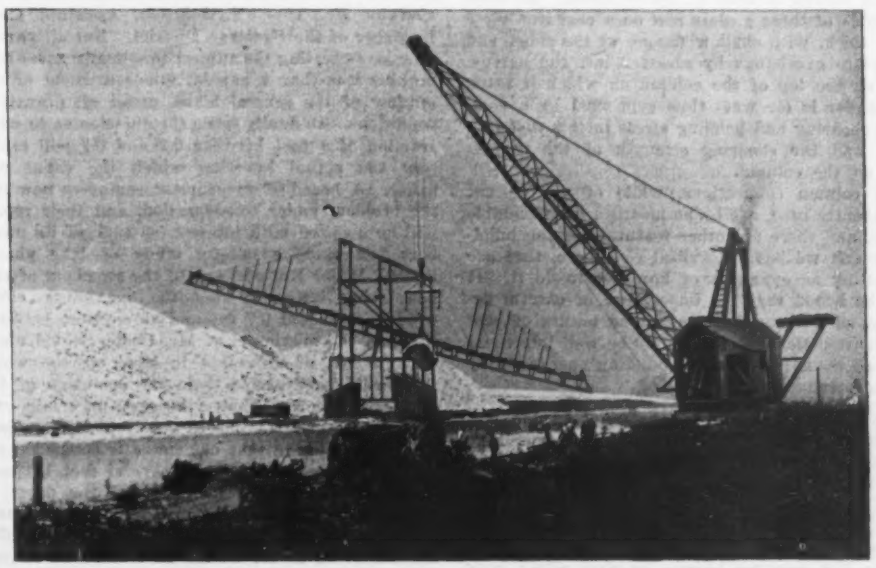

FIG. 70. VIEW SHOWING HULETT-McMYLER CONVEYORS AND DERRICKS ON SECTION 7

in. branches at various points for connecting the 1¼-in. air hose to the drills.

We are indebted to Mr. Wm. M. Christie, Engineer of the Qualey Construction Co., for the matter from which the illustrations, Figs. 65, 66, 67 and 69, have been prepared, and for much information regarding the work of these machines. Much aid has also been given us by the contractors, Mason, Hoge & Co., and by the engineer corps of the Sanitary District.

* The double-boom self-contained derricks on Section 14 of the Drainage Canal are larger, but this does not alter the truth of the statement about the Hulett-McMyler derricks, which are self-contained single-boom counter-balanced derricks.

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The strength of a chain is no greater than that of its weakest link is a well-known axiom in mechanics. Bridge engineers have long been aware of the similar principle that the strength of an iron bridge depends very much on the design of its details. In another column of this issue we have described and illustrated some details of the wrecked Ireland building in New York city, which go far to show that the same principle holds good in modern tall building construction. Our investigation has shown that each of the principal roof girders carries a load of approximately 30 tons. The ends of these girders rest on a cast iron plate ¾ in. thick, with shallow flanges at the sides, and this plate overhangs by about 2 ins. the narrow bead on the top of the column on which it rests. The girder is (or was) thus supported by a combined shearing and bending stress in this cast iron plate, and the shearing strength of the narrow bead on the column.

The column connections, while of a type not infrequently used, are by no means a commendable design, and there are other features of the building, which we have described elsewhere, that are interesting as examples of how not to do it. It is to be hoped that the importance of careful detailing, as well as the treacherous nature of cast iron construction generally, may be well impressed upon all those interested in building operations by this unfortunate disaster.

The managers of the Manhattan Elevated Ry. are congratulating themselves on the fact that the strength of a solidly constructed bumper at their City Hall terminal station saved the road from a terrible accident on Aug. 13, when a train entered the station and ran against the buffer with great force. Had the buffer been such a light and insecure barrier as that which was demolished by a train at a terminus of the Kings County Elevated Ry. in Brooklyn last January, this Manhattan train, with its crowded cars, would have probably gone into the street, and an appalling list of fatalities would have resulted. Too great care can hardly be taken in the construction of a buffer at an elevated railway terminal. It may not be needed for a century, or it may never be needed, but whenever it is needed, it is sure to be needed very badly.

The cause of the accident is said to have been the failure of the vacuum brake to apply. It is of interest to note that the engineer was so badly "rattled" by the failure of the air-brake, that he entirely forgot to signal for the hand brake, although an elevated train, with its guards on every car platform, is probably the one type of passenger train now running which can be stopped by hand-brakes with a fair degree of efficiency. Just what was the cause of the vacuum brake failure will probably remain a secret with the Manhattan Elevated officials, unless the State Railroad Commission choose to investigate the matter. The vacuum brake, which is still used on the Manhattan Elevated after practically all other steam roads have abandoned it, has been retained there because, while it does not give a quick emergency stop, it has been believed to be absolutely certain of application. It is the practice of the enginemen to test their brakes before every stop. The brake is applied lightly a hundred yards or so back of the point where the final application is made. That even with these precautions, and with the care which is ordinarily exercised in running into a terminal a collision with the buffer should occur, is by no means reassuring.

The probable effect of the Chicago drainage canal, when completed, upon the level of water in the lakes is a subject that is now receiving much attention from those interested in the drainage scheme and in lake navigation. Mr. L. E. Cooley, in a late report to the Trustees of the Sanitary District of Chicago, considers the technical problems presented, and arrives at the following conclusions: In the first place, the data at hand are insufficient to reach any conclusion as to the exact effect which the canal will have upon the lake levels; but the information available indicates a possible change of level somewhere between 0.2 and 0.4 ft. Mr. Cooley maintains that the current changes in lake levels now existing, due to wet and dry seasons, etc., are so much greater than this that any such relatively small results would neither be discerned nor appreciated by the public. Then, too, the future of lake commerce demands a deepening of the shallower connecting channels and harbors that would be mainly affected, and the maximum possible effect would add comparatively little to the cost of this deepening process. This report of Mr. Cooley is accompanied and sustained by a still more technical and mathematical discussion by Mr. Thos. T. Johnson, Assistant Chief Engineer of the Sanitary District. But all parties now investigating the subject practically agree that nothing less than a careful remeasurement of the outflow of the several lakes, under all prevailing conditions, can finally settle the question as to what fraction of a foot between 0.2 and 0.7 will represent the actual lowering which the canal will cause. A board of government engineers now has the problem under consideration, and their report will be awaited with interest, as each of its members has made a careful study of lake phenomena. Major Ruffner, one of the members of this board, has intimated that the maximum effect would not exceed 0.7 ft., and an average between this and the maximum of Mr. Cooley would mean about 6 ins. of difference in level, as the worst that could be expected from the operation of the drainage channel. Under the very uncertain conditions of lake level, due to purely natural causes, and in considering that commerce is compelled for safety to allow a margin of several feet between the nominal depth of channel and the draft of ships, the slight decrease in depth above mentioned would hardly seem to be worth the trouble taken over it, as far as the general public is concerned. An exact demonstration of the effect would be satisfactory to engineers; but, as Mr. Cooley says, except by the careful measurements and calculations of these engineers the public would never note the difference.

Judging from the progress report of the commission appointed to examine into the feasibility of the proposed New Jersey ship canal, there is no immediate prospect of active work upon that project. Stated in fewest words, this enterprise proposes the expenditure of $14,000,000 to $24,000,000 in constructing 31 miles of canal on the line of a waterway 92 miles long between New York and Philadelphia; or 78 miles, with Sandy Hook as a starting point. But Consulting Engineer Hutton very sensibly points out that to utilize this 31 miles of canal when built the national government must first improve and maintain about 40 miles of riverway. Mr. Hutton wisely recommends that the position of the government in connection with this enterprise be first made very plain before any money is spent upon building a 28-ft. ship canal with only 7-ft. approaches available. The prospective toll of 20 to 30 cts. per ton, taken in connection with existing transportation facilities and a time saving of less than 12 hours over the outside route, is not favorable to the development of any enormous traffic. From an engineering point of view it is interesting to know that a canal, with only 60 ft. of aggregate lift at each end, could be built across the state of New Jersey for a reasonable sum of money; but it is to be doubted if much more than this piece of information will result from the present investigation. Considered as a link in a strategic inner waterway, to be built at the cost of the government, or even as a "free waterway" for commerce, constructed by the same agent, the national finances are very unfavorable for any such consummation at present. As to the relative public advantages of such a waterway over existing or possible railway facilities for transport of goods, this journal has already put itself upon record. We believe in all improvements—ship canals or railways—that will result in real public gain, but the promised economy and business profit in many of these schemes are more apparent than real; and in the case of the proposed New Jersey ship canal the information available as to the collateral work, prospective traffic and cost of operation is yet too incomplete to warrant any safe conclusions in favor of the project.

A correspondent, Mr. F. G. Lippert, in noting our recent comment upon the efficient work of the designers and builders of the North Sea & Baltic Canal, corrects our quoted statement of the average cost of excavation per cubic yard on this work. By a misprint that cost was given at 53 cts., instead of 33 cts. But Mr. Lippert shows that even this smaller figure, as given in the press accounts, must be too high, as it would account for $33,000,000 out of the total $37,440,000. From an article in the "Deutsche Bauzeitung" our correspondent shows the total excavation to have been somewhat less than 80,000,000 cu. m., or 104,600,000 cu. yds. The cost of this work was given as 70,000,000 marks, or about $16,470,000. On this basis the average cost of the material removed would have been but 15¾ cts. per cu. yd.

Mr. Lippert also calls in question the total amount of excavation on the Suez Canal, as given in the table in our issue of July 11. While the figure used is found in several works describing this canal in our library, our correspondent's query has caused further search for data on what seems to be a very mixed item with writers upon this enterprise. We have failed to find either in the Astor Library or in the library of the American Society of Civil Engineers any work authentically giving the actual quantity of material removed in the Suez Canal up to the date of opening in 1869. Ferdinand de Lesseps, in his original reports submitted to the canal commission, and published in Paris in 1856, estimates the total excavation at 46,000,000 cu. m. removed in the dry, and 50,177,926 cu. m. removed by dredging, and he gives this as a maximum. The aggregate is 96,177,926 cu. m., or a little more than 125,000,000 cu. yds. Accounts of the progress of the canal in London "Engineering" of 1869 and previous years variously estimate the total material to be removed up to the date of opening in 1869; but the usual figure assumed is about 96,000,000 cu. yds. for a depth of 18 to 20 ft. in the channel. Taking an average, then, of these several accounts, we arrive at about 100,000,000 cu. yds. in round numbers, and must substitute this for the figure given in our issue of July 11, as being much nearer the probable quantity for the date assumed. The enlargement of the Suez Canal in 1885, according to a detailed article of that year in the "Transactions of the

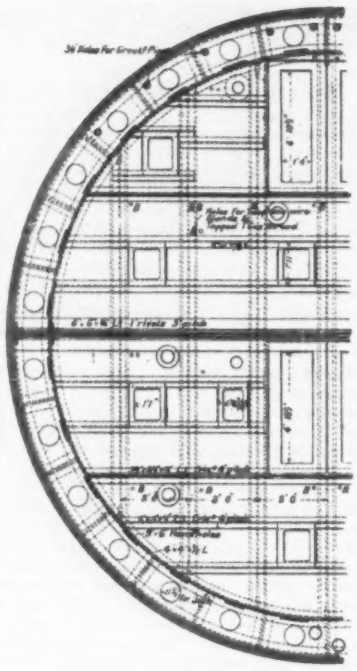


FIG. 2. HALF CROSS-SECTION AT A-A.

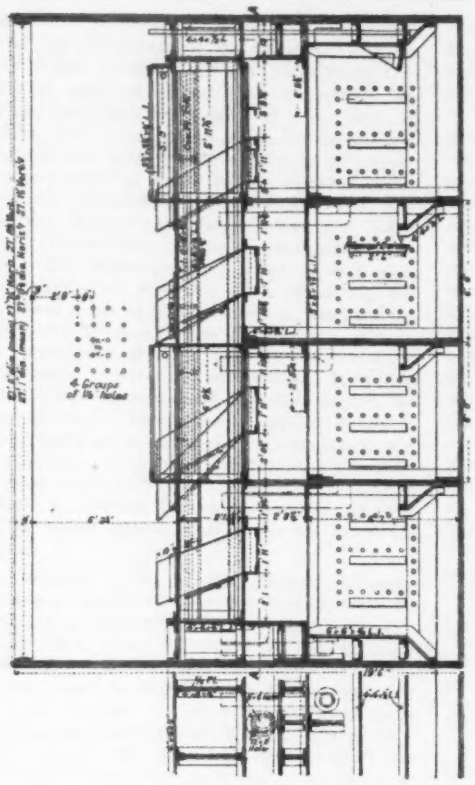


FIG. 1. VERTICAL LONGITUDINAL SECTION.

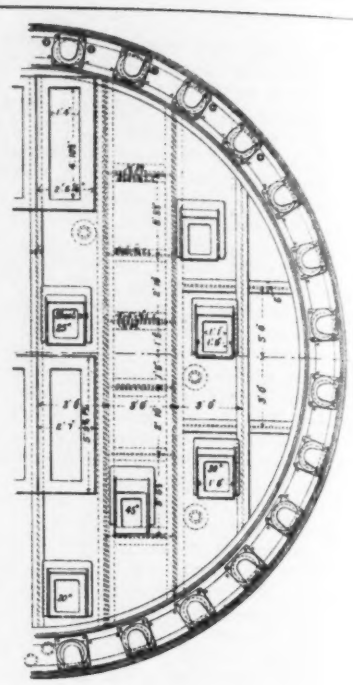


FIG. 3. HALF REAR ELEVATION.

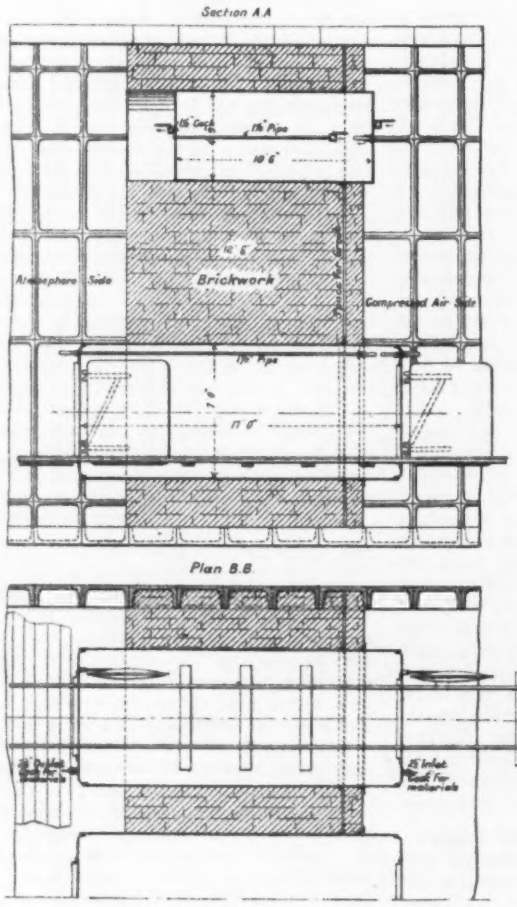
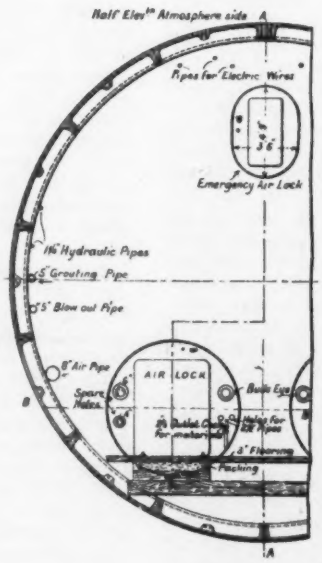
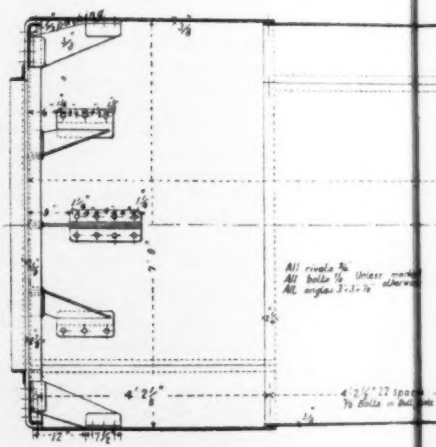


FIG. 8. BRICK BULKHEAD AND AIR LOCK IN TUNNEL.





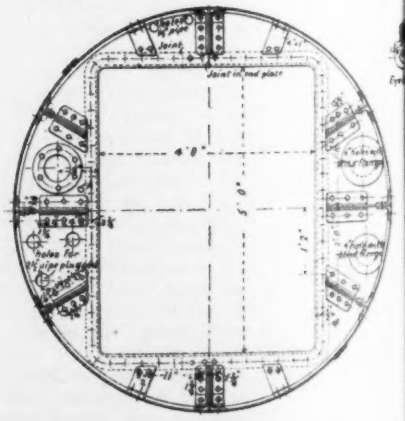


FIG. 9. AIR LOCK AND DETAILS.

HYDRAULIC SHIELD AND AIR LOCK USED IN CONSTRUC

A. R. BINNIE, M. Inst. C. E., Chief Engineer.

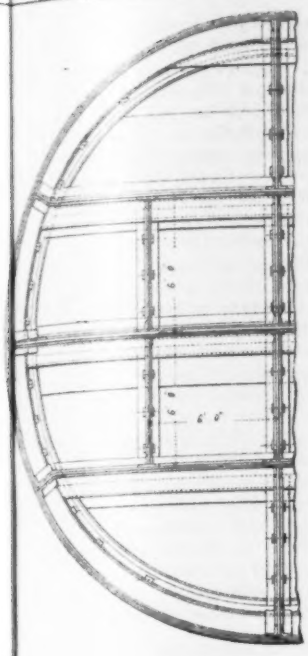


FIG. 4. HALF FRONT ELEVATION.

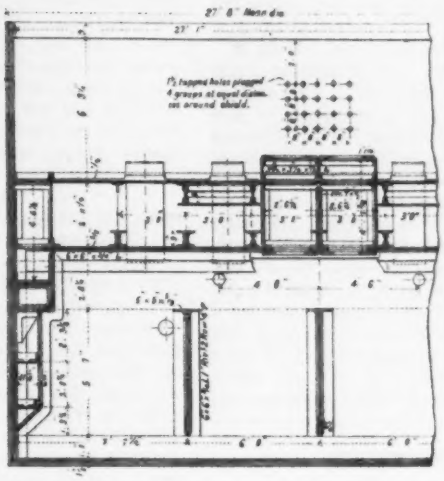


FIG. 5. PARTIAL HORIZONTAL LONGITUDINAL SECTION.

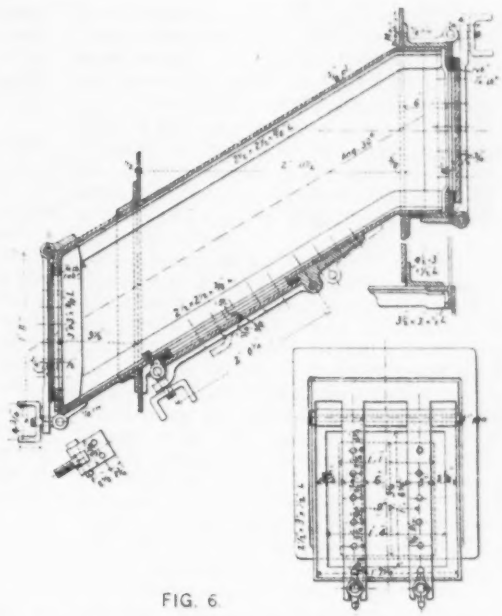


FIG. 6.

DETAILS OF CHUTE THROUGH DIAPHRAGM OF SHIELD.

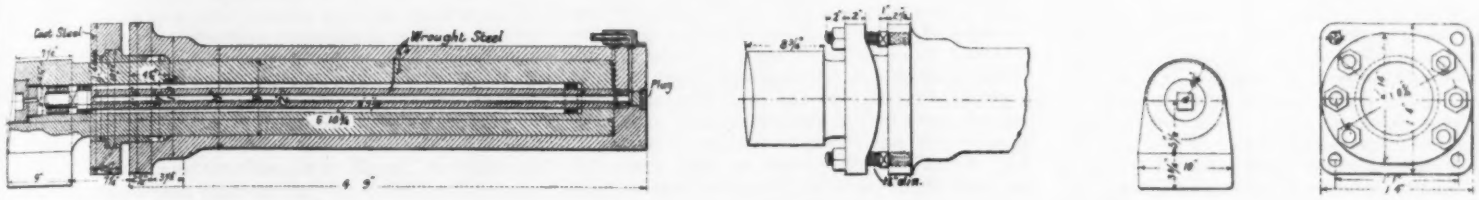
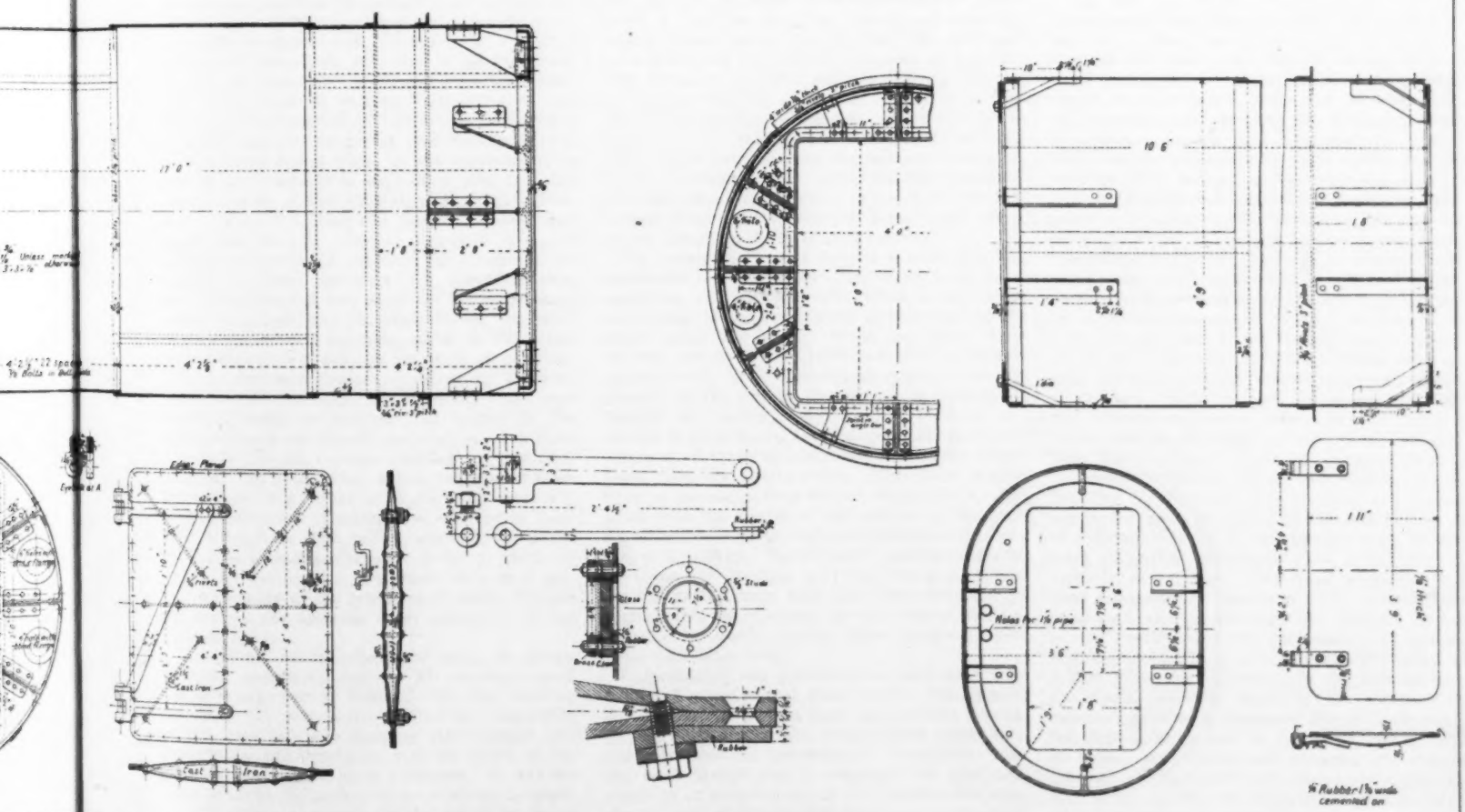


FIG. 7. DETAILS OF HYDRAULIC JACK.



ONSTRUCTING THE BLACKWALL TUNNEL UNDER THE THAMES.

Pearson & Sons, Contractors.

CHAS. HART & SONS, LITH., 35 VESEY ST., N. Y.

Austrian Society of Engineers and Architects," was to cost $41,293,403, and entailed the removal of an estimated quantity of 91,000,000 cu. yds., in widening the canal and in deepening it to 29½ ft., as then planned and since about completed. This later duplication of quantities, practically, has doubtless confused writers upon this subject, but we are indebted to our correspondent for calling our attention to what was evidently a gross error in our tabular statement in this item. We find no statement of the actual cost of excavation at Suez, but de Lesseps, in the estimates before quoted, figured the cost at about 13½ cts. per cubic meter in the dry, and at 20 cts. for dredging.

Another correspondent asks concerning the alinement of various ship canals, and in searching for data upon material removed we find the following concerning alinement on the Suez Canal in Mr. de Lesseps' report: As originally located, the canal was 89.91 miles long, and of this aggregate length 62.50 miles were on straight lines and 27.41 miles on curves. The minimum radius used on curves was 5,000 m., or 16,400 ft., and the maximum radius was 15,000 m., or 49,200 ft. The total amount of curvature is not stated, but the total length on the angular lines was 91.73 miles. How closely this projected alinement may agree with the actual construction we cannot say.

A new opening for sanitary engineers is promised by the recent engagement of a number of young men of this profession to perform some of the many duties which fall to the lot of municipal boards of health. About a year ago the Health Department of Brooklyn employed as sanitary engineer to the department a graduate of the Massachusetts Institute of Technology, who had had a few years of regular engineering work. In the recent inspection of New York tenement houses a number of young engineers were employed, and won high praise from the Tenement House Commission. Only a short time ago the city of Detroit was looking for a sanitary engineer to serve in its health department.

Among the smaller towns the first one, so far as we know, to show its realization of the value of engineering training as a qualification for the work of health inspector was Montclair, N. J. This suburb of New York has now a population of 12,000. In June, 1894, it engaged a graduate from that year's class in sanitary engineering at the Massachusetts Institute of Technology, who served as health inspector for a year. On leaving, to take up a different line of work, he was succeeded by a Cornell post-graduate in engineering, who took his regular course at the University of Sydney, New South Wales. During the present summer the board also has two assistant inspectors, who are engaged wholly in a sanitary house-to-house inspection. These assistants are undergraduates, one having finished two years in the engineering course at Lehigh, and the other having one more year in the general scientific course at Princeton, after which he will take up the study of medicine.

In choosing men just out of college for the position of health inspector, the Montclair board was governed partly by economy, but largely by the fact that there are scarcely any men to select from who have had the requisite training for this class of work. As nearly every health board must train its inspector if it wishes an efficient one, there is a decided advantage in taking him, if he be an engineer, when fresh from college, especially as actual experience in engineering work is not so much required for the position in a small town as a general knowledge of the principles of sanitation and an aptness for applying those principles to the work in hand.

In selecting undergraduates to make the house-to-house inspection, motives of economy again played a large part at Montclair, but they were by no means the only motives. Previous inspections of this class had been made by men engaged only temporarily, and principally with the object of discovering and abating gross nuisances. It was desired to make the inspection as thorough as possible this summer, and to place the results on file as the basis of a thorough sanitary record of every house in town. Such work, being largely of observation and record, in accordance with full instructions, can well be performed by undergraduates. As it gives the latter an opportunity to gain some valuable experience during the summer vacation, and to pay expenses as well, boards of health will seldom find any lack of bright young men ready to take up the work.

At present nearly all health inspectors are practicing physicians, who devote but a small portion of their time to the work, and are fitted for only a part of the duties of the office. Few local health boards have the technical knowledge necessary to handle successfully the questions in sanitary engineering which come before them. It therefore follows that those engineers who secure positions under health boards as inspectors or sanitary engineers will find great opportunities for efficient work. But the pay at the start, and perhaps in most places for a number of years, may be meager, as health board appropriations are at present generally small, and most of the inspectors heretofore employed have been giving only a part of their time to the work. In this, as in many other departments of the engineer's labor, he must prove the value of his services before he will receive what they are really worth.

PARIS SEWERS AND SUBWAYS.

The sewers of Paris are frequently quoted as models of construction, and they are generally regarded as equally remarkable for efficiency in operation. The interesting paper of Messrs. Bechmann and Launay on these sewers, which is abstracted quite fully in this issue, will lead to some change of opinion on this latter head. In construction the sewers of Paris are doubtless all that good material, good workmanship and faithful supervision can make them, and their design is excellent so far as their usefulness as subways for the storage of all manner of street pipes and wires is concerned. But as sewers, for the speedy and most economical removal of waste fluids, they are evidently far from being all that could be desired.

The fact that this elaborate system of sewers was designed for the removal of liquid waste alone will be new to some American readers. Until within a very few years no attempt was made to rapidly remove beyond the city limits the solid and more dangerous waste, and to those at all familiar with the very primitive sanitary conveniences of the average Parisian house, the typhoid fever record of that city is not surprising. The law of 1894, authorizing the expenditure of nearly $23,000,000 in extending and improving the drainage system of Paris, was directly called out by the high comparative mortality, and especially by the fact that the typhoid fever returns showed three times more deaths from that cause than in London.

The visitor in Paris is forcibly struck with the beautifully clean asphalt surface of the main thoroughfares, and the ease with which a seemingly small gang of workmen wash into the sewers all street refuse and snow. What the visitor does not see, but what the article referred to frankly admits, is the army of workmen employed underground, in the sewers themselves, in constantly keeping the drainage system clean, and in removing to some final point of disposal the sand and refuse of all kinds so easily pushed into the sewer inlets from the streets above. The Paris sewers have an enormous cross-section when this is compared with the section of the cunette, or the real sewer, which is simply an open channel in the bottom of a subway. Sewers under pressure seem to be absolutely wanting, and the ruling gradients are too flat to carry sand and other solid matter emptied into the drainage system without the application of much manual labor, flushing from tanks and other aids.

Unfortunately our authors in no place enter into the detail of the cost of these sewers. The system undoubtedly has a great value as a subway system for the disposal of pipes, underground wires, etc., and this must be considered in connection with the total outlay; and a statement of this cost would be of material use at a time when the subway disposal of underground pipes has its advocates in our own and other cities. The almost perfect condition of the Paris streets is intimately connected with the fact that the disturbance of this street surface by pipe trenches is practically eliminated. Water and gas pipes, telegraph and telephone wires, pipes for compressed and for hot air, and the entire tangle of fixtures and appliances buried under the streets of other cities are here disposed of in roomy, well-ventilated and well-lighted subways. Aside from the fact that this disposition does away with cutting into and replacing pavements, and prevents the obstruction of the streets by poles and overhead wires, there are other economic advantages.

Pipes buried in the ground are usually left to take care of themselves until some radical and apparent defect or leakage makes repairs imperative, not only on the pipes, but on the streets as well. In the Paris subway the pipes are always accessible; they can be kept in thorough repair and will consequently last longer; the smallest leak is at once detected and checked, and waste is prevented. Finally, when a new and better system is devised for any purpose, old fixtures can be removed and new ones put in with a minimum of expense, as compared with methods elsewhere. In New York under many streets old unused lines of gas and other pipes are rusting slowly away, interfering with street excavations and causing settlements as they collapse, simply because it will not pay to dig them up. With a subway system this would be impossible.

Paris, by limiting the least height of its smallest sewers to 6 ft., seemingly finds that the subway system pays in other directions, and it evidently means to continue the development of the system. This determination is the result of less than 30 years' experience, for in this period the subways have been constructed. Unhappily, the first cost of similar subways in this country, even for main thoroughfares alone, would be enormously high, and the cost of maintenance would be equally great. If our great cities had to build their drainage systems over again, in the light of modern demands and with the appliances now available, doubtless some innovation of this character would be included in their plans; the killing objection lies in the first cost of this reconstruction. But this is practically what Paris has done and is doing to-day, in spending nearly $23,000,000 more on its drainage and new water supply. In the disposal of its sewage New York is somewhat more fortunately situated than is Paris; but in other great and growing American cities this disposal problem is already assuming very uncomfortable proportions, and the experience of Paris will be studied, certainly with interest, and possibly with profit.

In many particulars our country is yet new; compelled to be content with temporary schemes, or the perpetuation of systems projected and largely constructed before the demands of modern civilization were fully appreciated, or many of the appliances for the convenience of men now in common use were even dreamed of. But, on the other hand, when we do make a new departure at the present time in elevated railways, electric traction, high buildings and the various other innovations of the last decade or two, we spare no money and develop unexpected resources of inventive genius and applications of structural material. New York is soon to begin the construction of an underground railway, which will include subway facilities for pipe and wire disposal, and it may not be too much to hope that the economic value of subways will be so far demonstrated by this work that other like construction, upon American methods, may follow. One thing is certain, that until some subway system is built, we can never have good and permanent street paving. And it is also certain that the perpetuation of present methods means, in a term of years, the waste of a sum of money equivalent to the cost of even the Paris subways; waste in the constant renewal of pavements, increased cost of street cleaning, leaking pipes, and the increased money spent in laying, maintaining and changing the present network of pipes and wires under our highways. But it is one thing to demonstrate this economy of a new system on paper, and it is quite another thing to induce the average citizen, taxpayer and law-maker to appreciate the economy of spending money to-day for the benefit of a generation to

come. Paris, with her system of government, can do this, and is doing it, because the municipal powers are able to decide what is best for the public health and convenience, and for the good appearance of the city. In the United States—it is different.

LETTERS TO THE EDITOR.

HOW TO BACK-FILL TRENCHES SO THAT SETTLEMENT WILL NOT OCCUR.

Sir: One of the most serious drawbacks and greatest losses that the various large cities are troubled with is the tearing up of paved streets for the purpose of putting in sewers, water and gas mains, and the laying of conduits for electric wires and similar purposes. The question of how to obviate the destruction of pavements, caused by the settling of excavations made for this purpose, has long troubled municipal authorities. I would suggest from my experience as a nearly perfect method of refilling trenches the following:

After laying the pipe, conduits, or sewer connections, fill the trench with sand thoroughly puddled. By this method the trench will be compactly and completely filled, and ready at once for the street pavement to be laid upon it. Of course the substitution of sand for the materials excavated would cost slightly more, and an ordinance compelling such filling would be bitterly opposed by all corporations supplying gas, electricity, etc. It would, however, result in the saving of hundreds of thousand dollars' worth of pavement each year to the taxpayers who once paid for the laying of such pavements. Yours truly, Fremont Hill.

1413-17 Chamber of Commerce, Chicago, Ill.,
July 24, 1895.

(We fear there are very few cases where the cost of carting away and disposing of the material excavated from a trench, and carting sand to take its place, would be adequately represented by the adjective "slight. In any city large enough to spend "hundreds of thousands of dollars" on street pavements, the disposal of earth from an excavation is generally very expensive. Further, in the long run, the public has to pay all the expenses of the companies which supply gas, electricity, etc.—Ed.)

SHOULD THE BUILDING OF STAND-PIPES BE ABANDONED?

Sir: In your issue of May 30, 1895, the question is raised, "Should the building of stand-pipes be abandoned?"

In the city of Terre Haute, Ind., a water-works system has been in use for 19 years without a stand-pipe, or tank, or reservoir, for pressure purposes. Water is pumped from the Wabash River and forced through high-pressure filters directly into the service mains. The filters are washed by reversing the direction of the water through them. The water so used is allowed to waste back into the river some distance below the intake. Analysis of the filtered water, at the Rose Polytechnic Institute, shows it to be nearly absolutely pure.

Diagrams from a recording pressure gage, showing the fluctuations of both supply and return mains, are taken continuously. During fires the pressure is increased from 70 to 80 lbs., the ordinary pressure, to 120 lbs. in from three to five minutes.

The pumping engines have fixed cut-off valves, adjustable by hand. They are self-regulating for a varying pressure of 10 lbs. If the variation is greater the supply of steam has to be regulated by the throttle. The pumps do not differ in any way from those used with stand-pipes or tanks.

The engines are five in number. The first pair were put in in 1875, the second pair were erected in 1886, and the fifth is a recent addition, built by the Holly Mfg. Co., and is nearly equal in capacity to the other four.

The boilers consist of a battery of three, built by Babcock & Wilcox, another battery of four of the ordinary return-tube type, and a single boiler, also of the latter type.

A 1,000,000-gallon reservoir is used for storage purposes only, as it is but 37 ft. above the pumps, and is kept full of filtered water for use when the filters are being washed.

The plant is of 3,500,000 gallons daily capacity, and consists, in addition to the engines and boilers mentioned, of eight high-pressure filters of 250,000 gallons each, and a reserve filter of 500,000 gallons. In addition to the above there are two gravity filters, of large capacity, standing adjacent to and just above the reservoir, for use when the river is high and muddy. These gravity filters are used for rough filtering only, and the muddy water, after passing through them, is pumped through the other filters. Their service has not been required this year.

There has never been a breakdown or a mishap of a serious nature, such as to stop the supply of water, since the plant was started 19 years ago. Mr. Williamson is the manager, and to his son we are indebted for the information contained in this letter.

Very respectfully, R. Hinchliffe & Co.

100 Washington St., Chicago, Aug. 12, 1895.

(Terre Haute is only one of many cities with direct pumping systems unsupplemented by storage which have given good satisfaction on the whole, but many, if not all, of which have their drawbacks. Most of the stand-pipes and tanks in this country are in small towns where sudden variations in consumption give rise to great fluctuations in pressure without previous warning. These fluctuations are far different than those common to fire demands, where the pumping engineer receives the fire alarm as soon as the fire department, and has his extra pressure ready when needed. In small towns, also, the stand-pipe or tank often plays no small part in the way of storage, frequently rendering pumping unnecessary for a number of hours at night. Undoubtedly stand-pipes or some equivalent system of pressure regulation and storage have come to stay—until they break down, as they too frequently have done during the last 10 years. —Ed.)

THE SEWERAGE SYSTEM AND SEWAGE FARMS OF PARIS.

The far-famed sewers and sewage farms of the great French capital are now being extended at a cost of over $13,000,000. The work involved includes the making of thousands upon thousands of house connections, lateral sewers, trunk sewers of all sizes, a great outfall sewer to the new sewage farm, immense pumping stations and the preparation of a large tract of land for irrigation and crop-raising. The very magnitude of the undertaking gives it great interest, which is increased by the nature of the operations and the bearing of some parts of the work upon the problems of American cities, notably the use of the sewers as subways and the purification of sewage by broad irrigation on sewage farms. The following comprehensive description of the Paris sewers and sewage farm, both past and future, has been compiled from the three sources named:

The Old System and the New Work.

In the "Annales des Ponts et Chaussees" for March, 1895, Engineers Bechmann and Launay describe the existing sewerage conditions in Paris and the works now under progress authorized by the laws of April 4, 1889, and July 10, 1894. Under the plan now being executed all the sewage of the city is to be carried to points remote from Paris and purified by land treatment on sewage farms. No sewage water is to be allowed to escape into the Seine, and all houses in the city are to be gradually connected directly with the sewers for the removal of all solid, as well as liquid, waste.

The article commences with the description of the drainage system as this existed on Dec. 31, 1893, and concludes with a general outline of the new work projected and partially completed. At the date mentioned there were three great collecting conduits, each serving a drainage basin, as shown on the map, Fig. 1. The first is the "Collecteur d'Asnieres," on the right bank of the Seine, and reaching that river at Clichy, gathering the sewage from an area of 6,239 acres. This collector is about 29,520 ft. long. The second collector, the "Collecteur Marceau," is located on the left bank of the river, and passes under the Seine, in a siphon, at the Pont de l'Alma, and then joins the first collector. It drains an area of 8,756 acres and is about 33,780 ft. long. The "Collecteur du Nord," the third main conduit, intercepts the drainage of the high ground on the north of Paris, and empties into the Seine at St. Denis. It drains an area of 2,833 acres, and is about 39,629 ft. long.

The section of the Asnieres collector is calculated for a flow of 141 cu. ft. per sec., and the exact dimensions for this and the Marceau and other collectors are given in Fig. 1. The sewers of Paris act not only as subterranean channels for the removal of waste water, but they also form galleries, everywhere accessible and well ventilated, and in them are carried the pipes for the pure water supply of the city, with an aggregate length at the present time of 1,001 miles of mains and distribution pipes. This disposal of the water-pipe system presents the advantages of permitting all leaking to be closely watched and at once checked, and of protecting the public streets from interference or damage. In addition to the water mains, the sewers also carry the telegraph and telephone wires, pneumatic tubes for mail and packages, and compressed air conduits for motive power. In this way all overhead wires are avoided, with the dangers to these wires from storms, and the interference with, and damage to, street paving by trenches is reduced to a minimum.

Every sewer is accessible and well ventilated, and the ovoid section of the smallest sewer has a least height of 5.9 ft. As to construction, these sewers are usually built of a light grit-stone, which is very strong and adheres well to the mortar, and the entire interior surface is lined with cement. The author credits Chief Engineer Durand-Claye with substituting for the old inverted arched bottom of the sewers the semi-egg-shaped bottom conduit, or "cunnette," with its narrow sidewalk, shown in Types 12 and 15, in Fig. 2. By this device he increased the depth of flow by reducing the width of the channel, and at the same time made the sewers more accessible and useful for other purposes.

The total length of the public sewers actually in service in Paris on Dec. 31, 1893, was about 587 miles; of these sewers about four miles lie without the walls of Paris. They are divided as to length and general type, as follows:

	Miles.
Collecting sewers, accessible to boats	12
Collecting sewers, accessible to wagons	26
Ordinary sewers	549
Total	587

The following table gives the principal dimensions and respective lengths of these sewers on Dec. 31, 1893, in metric measure:

Number for each type.	Height of abutments above footway.	Span of arch at spring.	Total height under key.	Section of sewer.	Total length.
	Meters.			Sq. mrs.	Meters.
No. 1	1.05	5.60	4.40	17.76	3,498
No. 2	1.05	5.20	5.35	17.91	1,730
No. 3	0.90	4.00	3.90	11.68	11,604
No. 4	1.05	3.70	3.70	9.89	298
No. 5	1.50	3.00	3.80	8.42	18,781
No. 6	1.50	2.50	3.15	7.04	19,200
No. 6a	1.50	2.50	3.55	6.93	4,660
No. 7	1.45	2.40	3.45	6.29	3,718
No. 8	1.25	2.30	2.80	4.81	12,575
No. 9	1.35	2.00	2.75	4.05	15,017
No. 9a	1.85	1.80	3.00	4.22	396
No. 10	1.15	1.75	2.40	3.00	74,750
No. 10a	1.195	1.75	2.40	3.13	3,671
No. 10b	1.225	1.75	2.40	3.08	1,929
No. 11	1.40	1.50	2.35	2.88	515
No. 11a	1.375	1.50	2.35	2.66	354
No. 12	1.65	1.30	2.30	2.15	349.3 8
No. 12a	1.35	1.40	2.30	2.46	74,549
No. 13	1.415	1.30	2.10	1.96	75,004
No. 13a	1.415	1.05	2.00	1.65	14,174
No. 14	1.55	0.90	2.00	1.63	46,294
No. 15	1.25	1.00	2.00	1.66	4,630
Unclassified	....	....	....	.....	208,430
Total					945.236

The gradient of the Asnieres collector, with a capacity greater than that of all the others, varies from 0.26 to 0.30 ft. per 1,000 ft. as far as the collector Coteaux, and beyond that it touches a grade of 0.56 ft. per 1,000 ft. The velocity of flow is further accelerated by a fall of 3.28 ft. at its confluence with the collector Marceau. This last collector, as well as those on the right and left banks of the Seine, has a gradient of 0.26 ft. to 0.30 ft. per 1,000 ft. The collectors with a "cunette" 1.20 m. (3.9 ft.) wide have grades varying from 0.30 ft. to 3.28 ft. per 1,000 ft. The small collectors, 0.80 m. (2.6 ft.) wide between the rails, have a fall of from 3.28 ft. to 4.92 ft. per 1,000 ft. The lowest gradients used on the collectors are sufficient to impart a sensible velocity to the sewage. The gradients of the ordinary sewers vary according to the elevations of the surface, and some grades are too light. The author figures that to prevent the lodgment of mud in the sewers, the least gradient should be 0.016 ft. per 1,000 ft., and that heavier material, such as sand, stops with a gradient of 0.033 or even 0.05 ft. per 1,000 ft. Above an incline of about 0.01 in 3 ft. the bottom becomes very slippery and dangerous for the sewer

attendants, especially when the volume of water is considerable; but falls of 0.164 ft., and even of 0.23 ft., in 3 ft. are found in the Paris sewers.

As accessories to the main sewerage system mentioned, there are 15,000 inlets, mainly under the pavements, and 11,200 branches, with a development of about 60 miles. Including the 46,500 special sewers, or branches, uniting the houses on the river banks to the public sewers, there is a total length of accessory sewers of nearly 250 miles. The entire Paris sewerage system thus has a length of not less than about 835 miles.

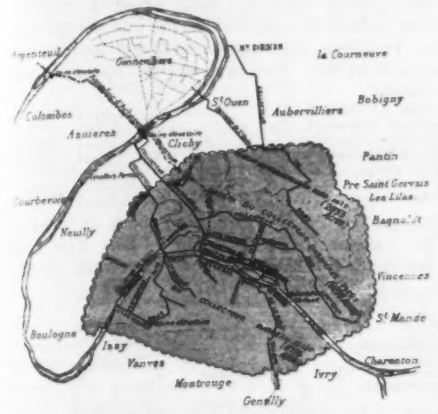


Fig. 1. Map of the Drainage Districts and Main Collecting Sewers of Paris.

The length of compressed air conduits for the distribution of motive power on Dec. 31, 1893, was about 90 miles, of which a little more than half were used in connection with pneumatic clocks. The conduits for rarefied air had a length on the same date of 2.2 miles. Among other special work connected with the sewerage system are six siphons, as follows:

Alma, under the Seine	two	3.28-ft. pipes
Cite, under branch of Seine	one	1.64 " p.pe.
St. Louis, under branch of Seine	"	1.31 " "
St. Sebastien, under Canal St. Martin	"	1.96 " "
De Chatillon, under Ceinture Ry.	gallery	4.9 × 2.6 ft.
Boulevard Morland, under Canal St. Martin	two	1.96-ft. pipes

There are also overflows into the Seine through which, in relatively rare cases, the surplus escapes when the capacity of the sewer is exceeded. There are at various points in the system sand chambers and gratings intended to arrest sand and floating materials. At the Place Mazas and the Quai des Orfevres there are pumping plants which, through the Morland and La Cite siphons, lift into the main collectors water too low for flow by gravity. At the first of these stations two steam engines operate centrifugal pumps; and at the second station four small turbines are operated by water taken from the city mains, and these turbines in turn operate centrifugal pumps.

The organization for cleaning the Paris sewers varies with the sewers themselves. The facility with which anything that soils the public streets can be pushed or washed into the sewer inlets under the pavements without doubt contributes much to that cleanly appearance of Paris streets which so strikes the visitor; but, on the other hand, the large sections given to the sewers are not adapted to methods of automatic cleaning, and they require the services of a large force of laborers which circulates each day through the sewers and maintains a free flow of water.

The important work of cleaning the sewers includes two principal operations—the cleaning of the main collectors and the cleaning of the ordinary sewers. The cleaning of the collectors has for its end the removal of all sand which the feebleness of the current permits to settle in the bottom of the cunette; and this sand is gathered into the sand basins provided and removed by processes to be described. The velocity of flow is increased for this purpose by artificial means—by movable dams, or wings, connected either to boats floating in the sewer, or to wagons with trucks running on rails placed at the upper edges of the cunette. Boats are used in the cases where the cunette is from 7.2 to 11.5 ft. wide, and where the cunette varies from 2.6 to 3.9 ft. in width the wagon on rolling trucks is employed. The wings, attached to the front of the boat or wagon, approach very close to the sides of the cunette, but leave a narrow opening around the wing, and the water thus partially dammed up provides the hydraulic force necessary to drive the sand forward. The sand is piled up and moves with the boat or dam, and in the Asnieres collector as much as 262 cu. yds. of sand is sometimes driven before the boat. With wagons the volume touches 65 cu. yds. and descends as low as 13 cu. yds. in the smaller sewers. In the Asnieres collector a least flow of from 35 to 42 cu. ft. per sec. is necessary to obtain the forward movement of the dam; in the Marceau collector a flow of 21 cu. ft. is sufficient, and in the smaller sewers, 9 cu. ft. per sec.

The sand catchers, Fig. 3, are formed of two parallel galleries, tied together, in which the bottom is 3.28 ft. lower than the bottom of the collector. The water is passed alternately into one of these galleries while the sand is being taken from the other. The obstruction of the several siphons by sand, at first much feared, is prevented by an ingenious contrivance devised by M. Belgrand. This consists in periodically circulating, from one bank to the other in each of the two pipes, a ball of wood, with a diameter of 2.79 ft. in the siphon de l'Alma, for example, or about 6 ins. less in diameter than the pipe. This ball is carried by the current, and as it floats it rolls along close to the upper side of the pipe. It acts thus like the dam in the sewers, leaving a passage for water under pressure, and drives the sand before it into the main collector. This operation is performed twice each week, the ball traversing the siphon in from two to three minutes.

The ordinary sewers are cleaned in several ways. Where the flow of water is abundant small dams are kept in place in the cunettes and raised at the time of cleaning, thus producing a more rapid flow. Where water is scarce the shovel has to be used in the hands of workmen. In rare cases the sand is lifted out of manholes and carted away in wagons, but generally it is loaded onto small wagons and carried on rails through the secondary sewers to some point on the Seine, or on the Canal St. Martin, and is there loaded into barges. When the small sewer, either regularly or temporarily, has a sufficient flow of water—about 2 cu. ft. per sec.—the laborer displaces the sand by a hand-dam; though this becomes dangerous as the volume of water held back becomes considerable. In the latter case the dam is attached to the front of a wheel, with which the workman is able to oppose a greater resistance to the flow. By various appliances of this kind the amount of sand removed from the manholes is practically reduced to nothing. And since the substitution of wood pavements for the old stone paving, the volume of sand entering the sewers has been very much reduced. Certain sewer entrances are now provided with sheet iron baskets, pierced with holes, which retain much of the sand from the macadamized roads, and also intercept the vegetable and other waste from the Halles Centrales and other great markets. On Dec. 31, 1893, there were in place 31 of these receptacles for sand, and 156 for floating material.

Until 1882 the workmen had to depend solely upon the sewage water for flushing purposes. But at that date a commencement was made in distributing water especially provided for sewer cleaning, and reservoirs of from 280 to 350 cu. ft. capacity were established in the sewers and fed continuously from mains leading in water from the Ourcq or the Seine. In 1886 there were 367 of these reservoirs, and there are now about 1,700. To insure the perfect cleansing of the whole Paris sewerage system, about 3,000 reservoirs would be required, and all new sewers built are thus provided, and many are being continually put into the old sewers.

These reservoirs are fed continuously, so as to permit from two to three flushings per day. The automatic flushing siphon is placed at midheight in the tank, so as to permit the escape of the upper layer of water, amounting to from 175 to 210 cu. ft., leaving the lower half of the contents of the tank always at the disposition of the laborer for other purposes.

The volume of water received in the sewers and led to Clichy by the city collectors is gaged periodically. In 1893 the mean volume was 103,202,857 gallons per day.

While the Paris sewers conduct the waste water outside of the city and into the Seine downstream from the city, a portion of it has for some time been used in sewage farming. As has been mentioned, there are three main collectors, as shown in Fig. 1, two of them uniting in a common trunk at Clichy on the Seine. These two collectors carry the bulk of all the Paris sewage flow; the third, the North collector, with a daily flow of from 13,200,000 to 15,800,000 gallons, strikes the Seine at St. Denis still further down the river. At first these collectors emptied into the river, and their mouths being well downstream from the city, there was no especial cause for complaint. But the city of Paris finally found it imperatively necessary to purify in some manner the flow from its sewers, and after studying all methods it selected that of sewage irrigation, or farming, and a beginning was made at Gennevilliers.

Following the experiments and teaching of de Freycinet, Schloesing, Marie Davy, Frankland and Mille, the engineers of Paris decided upon the purification of the sewage water by exposing it to the action of a permeable soil and that of vegetation. Experiments were made at Clichy

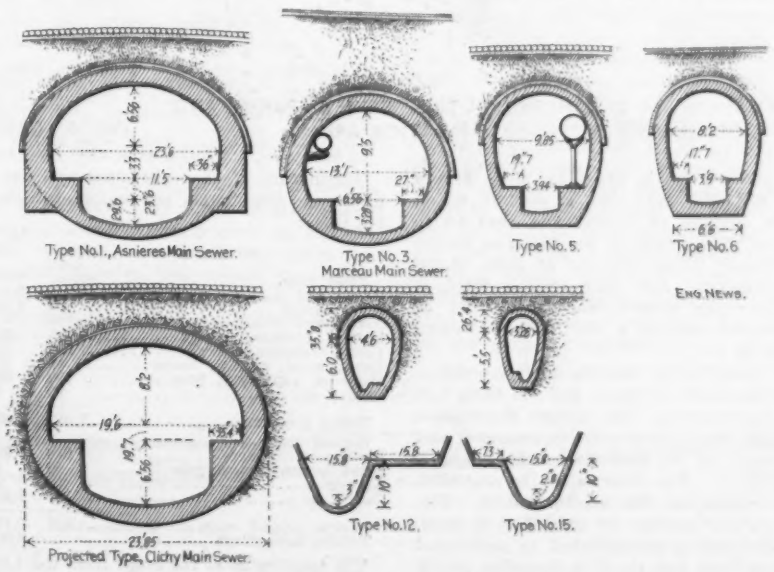


FIG. 2. TYPES OF PARIS SEWERS.

in 1866 and 1868, and in 1869 the sewage water was led across the Seine to the plain of Gennevilliers. Experiments were commenced on 15 acres of land near Asnieres, but the Franco-Prussian war interfered with these, and nothing was really done until 1872. Since the latter date the development has gone on steadily, until at the present time 1,917 acres of land are irrigated with 8,828,905,000 gallons of sewage per annum, or about 24,000,000 gallons a day. This is at the rate of 4,606,000 gallons a year, or 12,600 gallons a day, to each acre.

The health of this region is to-day beyond dispute. The population has doubled since 1872, and the value of land has risen from 100 to 450 francs per hectare, or from $8 to $36 per acre.

The irrigation service at Gennevilliers, Fig. 4, comprises three great divisions: (1) The supply of sewage; (2) its distribution, and (3) the underdrainage. The sewage is led to the plain by two distinct routes. One is by a gallery of masonry leading from the collector of the North, by gravity, to the two bridges of St. Ouen, across the Seine, and across these, in cast iron pipes, and in a conduit 3.28 ft. in diameter to the distribution center of Gennevilliers. The other route is by three masonry conduits leading to Clichy. At this point the sewage is lifted by three groups of pumps of 1,100 HP. into a conduit which crosses the bridges of Clichy and then on to Gennevilliers. The pumps of the first two groups have an average lifting capacity of some 14,250 gallons per minute, and that of the third is 28,512 gallons per minute, making a total of about 62,000,000 gallons a day lifted a mean height of 33 ft.

The main distribution conduits at Gennevilliers are built of masonry, or beton, and are from 3.28 to 4.10 ft. in diameter. The smaller distribution conduits range from 2.6 to 1 ft. in diameter, and the total length of all conduits at this place is about 161,761 ft. The distribution is controlled by 10 main gates and 800 smaller valves. The ridge and furrow system of irrigation is used. The under-drainage is accomplished by perforated pipes of beton, from 1 to 1½ ft. in diameter, placed about 13 ft. below the surface and emptying into the Seine. The total length of these drains is 35,175 ft., and they are disposed in five main lines, somewhat like the five radial lines of a semicircle.

The volume of sewage led to the collector at Clichy is about 103,000,000 gallons in 24 hours, or about 38,000,000,000 per year. To this must be added the flow from the collector of the North, and the total sewage carried from the city of Paris in 24 hours is thus about 117,000,000 gallons.

According to the analyses of 1887, the composition of this sewage flow is as follows:

	Parts per 100,000.
By the collectors Asnieres and Marceau:	
Organic matter	42
Mineral matter	83
Total	125
By the collector of the North:	
Organic matter	57
Mineral matter	104
Total	161

The approximate volume of water sent to Gennevilliers was 465,000,000 gallons in 1872; this reached 2,815,000,000 in 1874, 3,970,000,000 in 1880, 6,045,000,000 in 1884 and 8,830,000,000 gallons in 1893. In the year last named the sewage came in about equal quantities from the lifting plant at Clichy and from the collector of the North. In 1893 the maximum volume of sewage diverted to this use was about 1,033,000,000 in June, and the minimum was about 395,000,000 gallons in February.

The distribution of sewage water at Gennevilliers is free, each cultivator taking as much as he needs; and in 1893 each acre of land absorbed an average of about 4,606,000 gallons, which is at the rate of 12,600 gallons a day.

The nature of the cultivation and the amount of sewage distribution are indicated in the following table:

Crops.	Area acres.	Million gals. sewage. Total.	Per acre.
First crop.			
Grass land	148	2,345	15.84
Lucern-grass	124	1,445	11.63
Artichokes	198	772	3.90
Flower gardens	185	642	3.47
Leeks, cabbages, celery	272	590	2.17
Beets, salad, carrots, beans	99	130	1.31
Potatoes, asparagus, peas	792	687	0.85
Onions, etc	99	43	0.43
Totals, first crop	1,917	6,654	3.47
Second crop.			
Leeks and cabbages	618	853	1.38
Salad, beans, turnips, peas	49	43	0.88
Sundries	12	21	1.75
Ca.matage	124	1,255	10.12
Totals, second crop	803	2.174	2.71
Totals, both crops	...	8,828	4.61

The total value of the crops from the 1,917 acres of irrigated land at Gennevilliers has been approximately placed at $373,100. The return for the various crops is relatively very high. Artichokes grow at the rate of from 14,500 to 20,000, and even 32,000 heads per acre; cauliflowers, from 8,000 to 12,000 heads per acre; carrots, from 24,000 to 32,000 heads; cabbage, up to 126,000 lbs. per acre; potatoes, from 26,000 to 35,000 lbs. The rough product per acre obtained by the cultivators varies in value from $240 to $800.

The subsoil water has remained at almost a constant level since the establishment of the underdrains. These drains are cleaned annually by passing through them an iron "hedgehog." The effluent from the under-drains is clean to the eye, and its general purity is proven by many analyses. The quantities of organic or ammoniacal azote (nitrogen) in the effluent never reach 0.01 part per 100,000, and the bacteria never exceed 5,000 per cu. cm., while the water of the Vanne contains 3,000, the water of the Seine at Bercy, 80,000, and the water in the Paris sewers, 30,000,000 bacteria per cu. cm.

The total cost of the installation at Gennevilliers to the present date has been about $1,040,000. This is divided as follows: Works and supply conduits, $448,000; distribution, $452,000; sundry expenses, $140,000. The expenses for operation are as follows:

Salaries of staff	$28,000
Supplies; charcoal, coal, etc.	13,000
Repairs on machines	5,000
General expenses and repairs of roads	6,000
Repair shops, dredging in Seine, etc.	32,000
Total	$84,000

The cost of lifting 1,000,000 gallons of sewage 33 ft. high at Clichy is about $7.25. The cost of distributing 1,000,000 gallons of sewage on the plain of Gennevilliers is $1.62.

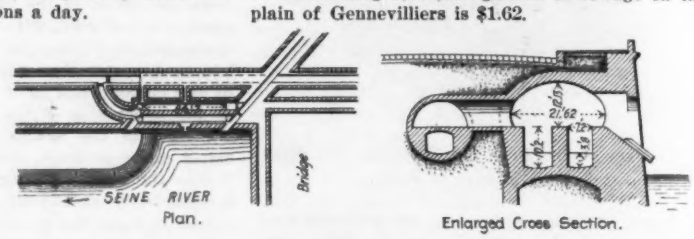


FIG. 3. SAND CATCHER ON THE PARIS SEWERS.

FIG. 5. LOCATION OF D' ACHERES OUTLET SEWER, PARIS, AND ACTUAL AND PROPOSED IRRIGATION AREAS.

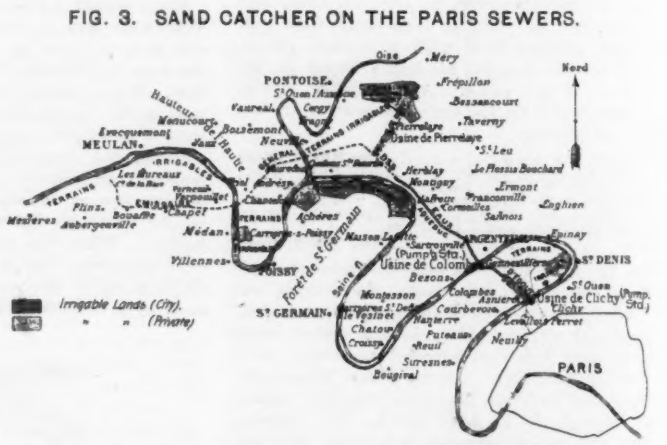


FIG. 4. GENERAL PLAN OF THE GENNEVILLIERS SEWAGE FARM

The foregoing matter briefly describes the situation at Paris at the end of 1893, and we have now to consider the projected work and work executed as a result of the new law of July 10, 1894. This law, taken in connection with that of April 4, 1889, has for its watchword "Tout a l'egout"—"all to the sewers"—and includes the transformation of the sewerage system, the extension of irrigation with the sewage water and the increase of the potable water supply. It means briefly that hereafter no sewage is to be turned into the Seine at any point, and that all excremental matter is to go to the sewers, instead of being periodically removed by other means from various receptacles.

The reason for this new departure is found in the injurious influence of the present system upon the public health, for the mortality in Paris is sensibly greater than that in other cities where the conditions proposed for Paris already prevail. The general mortality of Paris is 21.6 per 1,000, as compared with 21.3 in London, 20.7 in Berlin and 18.3 in Frankfort-on-the-Main. Further, typhoid fever causes 75 deaths per 100,000 inhabitants in Paris, while from this cause there are only 25 in London for the same number of inhabitants.

In 1880, with 14,000 earth-closets in Paris, the administration first proposed to the municipal council to extend to the solid wastes the same facilities for removal previously provided only for

liquid waste. The administration demanded means for turning the fecal matter into the sewers, and wanted to entirely suppress the fixed and movable privies; it asked for the promulgation of a law making house connections with the sewers obligatory, and the proceeds of the tax to be imposed were to be applied to the condition of the sewerage system and the purification of the sewage. These propositions were made the subject of a law passed on June 23, 1880, and a technical commission was finally appointed on Oct. 25, 1882, to consider the whole subject by the advice of M. Alphand, then Director of Works. The recommendations of this commission formed the basis of

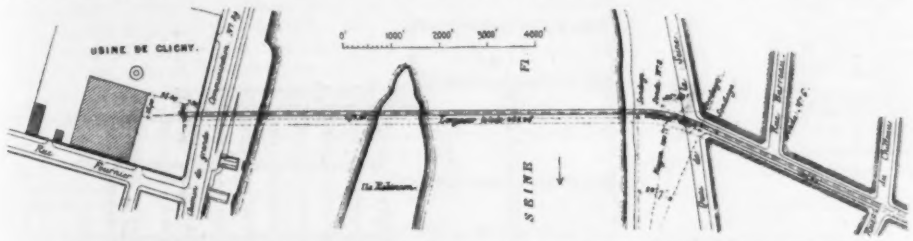


FIG. 6. PLAN OF CLICHY-ASNIERES SEWAGE TUNNEL UNDER THE SEINE.

a project submitted to the municipal council on Nov. 14, 1883, and by the end of 1886, 364 house connections were made directly with the sewers, 245 of these paying a $6 tax, and 119 a tax of $12. At the present time there are 11,000 of these house connections. Various municipal laws were passed in later years having for their object the development of this project, until on April 4, 1889, it was declared that public necessity required the construction of the works necessary to conduct to Acheres the sewage of Paris, raised by the machines at Clichy, and to deliver it on sewage farms at the rate of 4,225,000 gallons per acre per year.

This law definitely fixed the manner of purifying and utilizing the sewage, and 1,976 acres of land were secured at Acheres. The total estimated cost was placed at about $2,000,000, and work was commenced in 1891. But, assuming that one acre of land would purify 4,225,000 gallons of sewage per year, to treat 36,960,000,000 gallons would require the city to secure 8,743 acres of land. About 25,000 acres of suitable land was found about Acheres, and to reach it, it was decided to build a great aqueduct with a capacity of 353 cu. ft. per sec., or nearly 235,000,000 gallons a day. The law of 1894 authorized the city of Paris to expend 117,000,000 francs, or $22,795,000, applicable as follows:

(1) To lift the sewage and lead it to the lands for sewage farming; to acquire these lands, etc.	$5,975,000
(2) To complete the sewerage system of Paris and remodel existing sewers and build new collectors	6,829,000
(3) To complete the distribution of water, construct reservoirs, improve and add to existing water mains, build filter basins, aqueducts, and canals for the procuring of potable water from the Loing and Lunain	9,700,000
(4) Expenses of the loan	291,000
Total	$22,795,000

Article 2 of this law requires the house proprietor to make an underground and direct connection with the sewer for all solid and liquid matter, on all streets provided with a public sewer. Three years' time is given for this transformation in old houses. The tax imposed upon householders is based upon the value of the house, and is as light as possible upon those of small value; but in any case it is less than the present actual cost of removing fecal matter from these houses.

Article 3 authorizes the city to collect from the owners of houses on the river bank an annual tax, to be devoted to providing means of connecting with the sewers. This tax ranges from $6 per annum, on a property returning a revenue of 100 to $300, to $300 per year on a property worth $20,000 and over per annum. A city ordinance of Aug. 8, 1894, requires the use of sufficient water to insure the thorough flushing of the house fixtures and the speedy removal of all solid matter to the sewers. To do this, an automatic flushing tank, with a water-seal to the closet, must be used in all new and old houses, though some concessions are yet made in the case of old houses.

In connection with the amount set aside for completing the Paris sewerage system, improving old sewers and building new collectors, the following remarks may be made: Of the 713 miles of sewers necessary for the drainage of all the streets of Paris, only 586 miles are now in existence. A large number of the old sewers are badly adapted to the rapid discharge of liquid and solid wastes, for they have flat bottoms, rough sides and insufficient fall. All these have to be changed or rebuilt. The collectors themselves have been built for about 30 years, and are now insufficient for the service demanded of them. An estimated sum of $9,312,000 is set aside for this new work, divided as follows: For building 127 miles of sewers, $5,432,000; improving old sewers and adding more flushing tanks, $2,328,000; building additional collectors, $1,552,000.

A law of July 22, 1892, appropriated $3,880,000 to make a beginning upon this work, and the remainder is included in the estimates under the law of July 10, 1894.

As showing the actual conditions in Paris on Dec. 31, 1893, the following list is given:

Flushing pipes connected with water closets and leading to pits outside the house	139,527
Fixed pits, or ordinary privies	64,175
Movable closets (with suspended buckets)	16,353
Tinettes, or earth-closets	34,633
Closets of various other types	402
Direct connection with sewers	10,934
Total	266,044

In 1889 there were only 3,000 direct connections with the sewers after modern methods in other cities; the larger number in the above list simply led the waste to pits outside the house, which pits had to be periodically emptied.

Among the important work contemplated in connection with the increase of the sewerage capacity is the construction of a large collector leading to Clichy, which will surpass all the others in size. This collector, shown in Fig. 2, will be elliptical in section, with a width of about 20 ft. at the springing line, and a height of 16½ ft.; the cunette will be 13 ft. wide and 6.56 ft. deep, with two footways each 3 ft. wide placed 1.64 ft. below the springing line. This collector, with a fall of 6 ins. per 1,000 ft., will have a capacity of 508.6 cu. ft. per sec., or about 330,000,000 gallons a day.

The extension of sewage irrigation will include several operations estimated to cost as follows:

(1) At Acheres; the construction of an aqueduct between Clichy and Acheres, and the development of 1,976 acres of land authorized by law of April 4, 1889	$2,095,000
(2) At Mery-Pierrelaye; works for leading and distributing the sewage, drains, works, acquisition of land and preparation of the land	2,095,000
(3) New fields of purification in the valley of the Seine	2,910,000
(4) Buildings, materials, tools, etc.	970,000
Total	$8,012,000

The aqueduct of Acheres, the route of which is shown in Fig. 5, will be finished this year, and irrigation will be commenced on lands near the forest of Saint Germain, of which the city took possession on March 1, 1894. As built, this aqueduct has a capacity of 344.4 cu. ft. per sec., or about 220,000,000 gallons a day, while the present flow of the Parisian collectors is now less than one-half of this amount. It has a length of about 9.3 miles from the lifting pumps at Clichy to the land to be irrigated, of which 1¾ miles is made up of conduit under pressure and the rest is free. In the free portion the fall is 6 ins. per 1,000 ft.; the general section is circular and 10 ft. in diameter, but it varies in its dimensions according to the profile of the land. This conduit is figured to run three-quarters full. In the portion under pressure the uniform inside diameter is 7.54 ft. from the works at Clichy and under the Seine, with four pipes 3.61 ft. in inside diameter upon the bridge-aqueduct of Argenteuil; two conduits of 5.9 ft. diameter upon the side of the hill of Argenteuil, and finally two conduits of 3.28 ft. each for the branch which descends into the valley Herblay and crosses the Seine to the Saint Germain sewage farm. To insure absolute security and reduce the expenses for repairs, the conduits under pressure are strictly confined to the sections where they are absolutely necessary, and these are enveloped in masonry in the vicinity of inhabited centers. Not the least advantage of a free conduit is the constant presence of air, which is opposed to the development of certain microbes which are the active agents of fermentation.

The aqueduct crosses the Seine three times. First, between Clichy and Asnieres, where M. Berlier has designed and built a siphon 1,584 ft. long and located 52 ft. below the surface of water in the river. The construction of this siphon is described below. The aqueduct crosses the Seine a second time at Argenteuil, on a steel arched bridge of three spans, two of 219.76 ft. and one span of 229.6 ft. The third crossing is at Herblay, by means of a siphon 675 ft. long, made of two iron pipes each 3.28 ft. in diameter. These pipes were assembled on barges, floated over a trench dredged in the river and sunk between guides by loading them with old rails. They were sunk in 2½ days, in September, 1893, and were then covered with a bed of cement beton, deposited under water. This work was finished on July 31, 1894, in 13 months from the time of beginning.

The 10-ft. masonry aqueduct, between Clichy and the bridge of Argenteuil, was commenced in June, 1893, and is now completed. The gallery of 17-ft. span which covers the two 5.9-ft. pipes at the bridge of Argenteuil was built on the Coignet system, by using a network of steel rods imbedded in 5 ins. of Portland cement mortar.

To lift the sewage into the aqueduct of Acheres, there are two pumping establishments; one at Clichy, of 1,200 HP., and the second, the "Usine

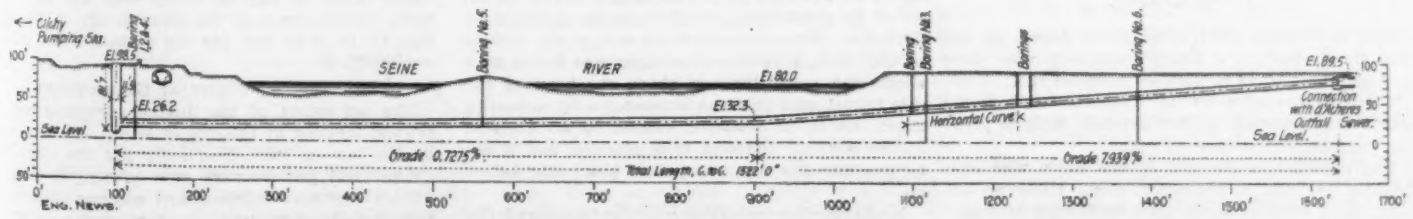


FIG. 7. LONGITUDINAL SECTION OF CLICHY-ASNIERES SEWAGE TUNNEL UNDER THE SEINE.

de Colombes," of 1,500 HP., at Petit-Gennevilliers. By thus doubling the lifting plant the high pressure and its attendant dangers are avoided on the section crossing the peninsula of Gennevilliers. The latter plant lifts the sewage from an elevation of 78.72 ft. to the highest point on the hill of Argenteuil, at an elevation of 196.8 ft. The four old machines at Clichy will be removed to Colombes, as their slow stroke and the power of their cylinders well adapt them for working with the piston pumps required for this lift of 118 ft., while the centrifugal pumps to be used at Clichy require a high velocity.

After the development of the sewage farms at

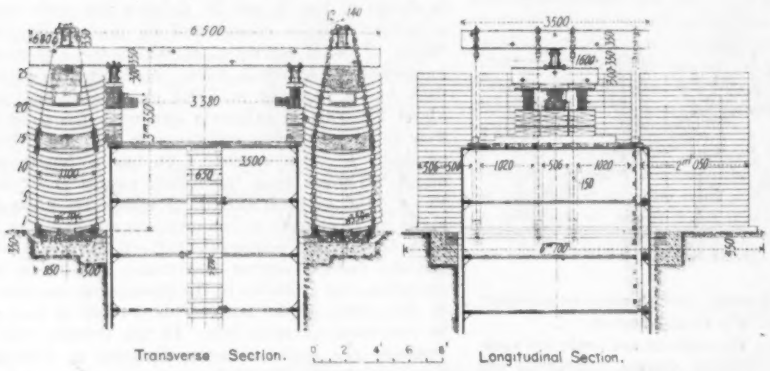


FIG. 8. WEIGHTS USED IN SINKING CYLINDER SHAFT FOR SEWAGE TUNNEL.

Gennevilliers and Acheres is practically completed, irrigation will next be extended to the lands acquired at Mery. This would mean the extension of the aqueduct temporarily stopped at Herblay, Fig. 5. By extension this same aqueduct could conduct the sewage down the valley of the Seine, even as far as the neighborhood of Mantes. It is expected that after July, 1899, the works now under construction will be so far completed that all flow of Paris sewage into the Seine will completely cease.

The Clichy-Asnieres Sewage Conduit under the Seine, at Paris.

The Clichy-Asnieres conduit, or siphon under the Seine, shown in plan and longitudinal section by Figs. 6 and 7, is intended to convey the sewage from the right to the left bank of the Seine, and it connects with the open aqueduct which carries this sewage to the irrigation grounds at Acheres. The work was authorized in 1889, and was com-

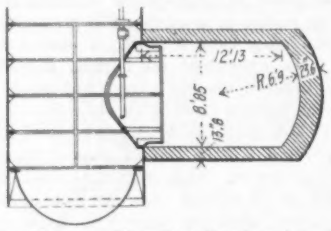


Fig. 9. Masonry Chamber Employed to Start Tunnel Heading.

pleted in October, 1894, after plans drawn up by Mr. G. B. Berlier, a French engineer, who carried out these plans at his own financial risk. The "Nouvelles Annales de la Construction," from which the following matter is taken, fails to give the very important item of cost.

The material in the bed of the Seine was extremely variable in character, being made up of mud, sand, pudding-stone, marl and ledges of limestone. The tunnel was located chiefly in the marl stratum, but sand-pockets and fissures carrying water made the use of compressed air necessary.

The siphon, including the vertical portion, was made entirely of cast iron. The shaft was 11.48 ft. in outside diameter and 78.7 ft. deep, and was located on the right bank of the river at the Clichy sewage pumping station. From the bottom of this shaft a tunnel, 8.2 ft. in diameter, extended a total distance of 1,518.6 ft. with two successive gradients, the one of 7 per 1,000 under the river, and the other of 80 per 1,000 under the left bank. In plan the tunnel was located upon two tangents connected by a curve of 328 ft. radius.

The shaft was built up of solid cast iron rings, each 3.28 ft. high, 11.48 ft. in outside diameter and 1.3 ins. thick, connected by flanges and bolts. The horizontal portion is also made of cast iron rings. Each ring was 1.64 ft. long, 8.2 ft. in outside diameter and 1 in. thick; it was cut on its circumference into five segments of equal length, with a small key-piece, and these segments and the rings were connected by flanges and bolts. The outside of this cast iron shell is completely covered by a layer of cement mortar forced through holes in the plates by the air-pressure; and the inside of the completed shell was lined with 3 ins. of cement mortar.

The shaft rings were put in place, first by excavating in the dry material, then by removing the material by dredging, and finally by the use of compressed air. A weight of 200 tons suspended from the ends of a system of I-beams was used in forcing the cylinder into the ground, as shown in Fig. 8. Notwithstanding this imposed load the descent was very slow, and was at times completely arrested. In such cases dynamite was exploded in the ground at the base of the shaft, and the shock produced materially aided the sinking process. It required eight months to sink the shaft to the depth required—78.7 ft.

The opening of the lateral gallery at the bottom of the shaft presented serious difficulties. The soundings called for a bed of compact marl practically impenetrable by water at this point. But the marl was found to be full of fissures, very irregular in formation and containing sand-pockets, and the pumps at the bottom of the shaft showed a flow of water equal to nearly 53,000 gallons per hour. The original plans had to be much modified as a consequence of these conditions. It was first necessary to seal the bottom of the shaft, and to do this a wrought iron cap, semi-spherical in form, had to be bolted to the first ring of the shaft above the cutting edge, as shown in Figs. 9 and 10. This operation was very difficult, as it required the handling of 7,040 lbs. of material under 66 ft. of water; it had to fit snugly and to be secured by a false ring of 20 segments fastened by 60 bolts. When this material was at the bottom of the shaft, a conical diaphragm was bolted to a shaft ring some distance above the level of the side tunnel, and this was surmounted by a smaller shaft, 3.4 ft. in diameter, capped by an air-lock. In the working chamber thus provided and under air pressure the cap was put in place and bolted up.

Next came the connection with the tunnel and the setting-up of the shield with which this tunnel was to be driven. A false plate closing the opening in the side of the shaft adjacent to the tunnel had been provided, and this was removed and a small chamber was built in brick masonry outside the bottom of the shaft sufficiently large to contain the shield, and strong enough to resist the water pressure, as shown by Fig. 9. When this had been done the diaphragm and air-lock and its shaft, in the main shaft, were removed and connection made with the open air. The shield and the plates shaped to connect the shaft and tunnel were then lowered to the bottom, and the diaphragm and air-lock were restored, and compressed air again admitted to the working chamber. With the connection made and the shield in place, the masonry chamber was demolished and 164 ft. of the tunnel was built under these conditions. A horizontal air-lock of masonry was then constructed 115 ft. from the shaft. This air-lock was 19.6 ft. long, and the interior section was rectangular in form, with a slightly arched roof, and the wrought iron doors at either end were 1.2 in. thick. The compressed air apparatus in the shaft was then removed, and the removal of

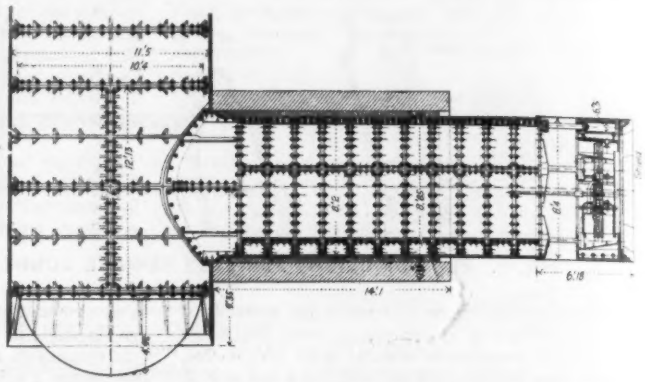


FIG. 10. SECTION THROUGH BOTTOM OF SHAFT AND TUNNEL HEADING.

the debris was made easier by putting in place more powerful hoisting plant.

The remainder of the tunnel was driven under air-pressure, with a maximum of three atmospheres. The air-lock being fixed, the working chamber was being continually lengthened, though no especial difficulty resulted from this arrangement.

The shield used, shown in Fig. 10, was 3.93 ft. long, and the cylindrical prolongation to the rear had an interior diameter of 8.33 ft., so that it slipped over the tunnel rings for a distance of 2 ft., or a little more than the length of one ring. The total length of shield and ring was 6.18 ft. The front of the shield was provided with a cutting edge and pierced by a door for the use of the miners, and five hydraulic presses, fixed in the ring of the shield, pushed it forward by acting against the tunnel rings already in place. In placing the tunnel ring segments, slips of pine ⅜ in. thick were bolted between the flanges, and these, by swelling, made the joint watertight. The 1¼-in. space left about the tunnel ring by the advance of the shield was filled with cement mortar forced in through holes in the plates, under three to four atmospheres, by means of a special grouting apparatus. When completed the whole tunnel was lined with cement mortar, reducing the interior diameter to 7.54 ft.

The construction of this work extended exactly over two years—from October, 1892, to October, 1894. No accident occurred, and the greatest advance made in any 24 hours was 8.2 ft. The work was executed on the plans of Mr. J. B. Berlier, C. E., who had for his assistant Mr. Alain Amiot, C. E.

Irrigation in Winter at Gennevilliers.

The opponents of the further development of sewage farming by the city of Paris, as authorized by the law of 1894, frequently put the question, "What will you do with your sewage in winter, when the ground is frozen and will not absorb the quantity of sewage you have conducted to it?"

To answer this question in a satisfactory manner, Mr. Launay, Sanitary Engineer of the Department of the Seine, has been conducting a series of experiments, and, on April 24, he gave the results of these experiments to the Society of Public Health. The following extract is taken from our contemporary, "Le Genie Civil":

The experiments were made between Jan. 1 and Feb. 28, 1895, in which period there were no less than 49 days of frost; and between Jan. 26 and Feb. 20, especially, the mean daily temperature

was constantly below freezing, and frequently touched 15° F., with a minimum of 1.4° F.

During this period 1,217,896,000 gallons of sewage were spread over 338 acres of sewage farm—about 60,000 gallons per acre per day. The general allowance for irrigation, on the other hand, is, in round numbers, 11,500 gallons an acre daily.

On Feb. 28, with a temperature of 26.6° F., soundings were made at three different points to examine into the condition of the soil. Each hole was 3.3 ft. deep, and they were spaced about 328 ft. apart; one was in soil unwatered and the other two were located in irrigated land. In the first case, in the unwatered soil, the ground was found to be solidly frozen to a depth of about 20 ins. In the second hole they found, first, a thin layer of ice about 2 ins. thick; under this an empty space of about the same thickness; then came a bed of deposits 2 ins. thick, which last covered the unfrozen natural soil.

Irrigation between 7 a. m. and 5 p. m. in winter was able, by the mean temperature of the sewage water, ranging from 42° to 46° F., to destroy the effect upon the soil of the strongest frost operating through 14 hours. The sewage would crack the layer of ice formed during the night, melt it and sink into the soil.

Mr. Launay believes this experiment effectually refutes the doubts expressed concerning sewage farming in winter. From an agricultural point of view, it should be considered that of the 1,218,000,000 gallons of sewage utilized in this experiment, nearly 590,000 gallons were poured out upon land left naked since the last harvest, and were thus prepared for the following season. Independently of enriching the soil, nearly one-half of this sewage was used in preserving from frost plantations of artichokes—a plan much more simple and economical than the usual covering with straw. And winter vegetables could be cultivated and gathered at all times on the place—a point of great value to the cultivator, when it is considered that leeks, for example, sell for 39 cts. the box in winter, as against 7 cts. in summer, and cabbages sell for $4 per 100, as compared with $1.75 in the summer.

SOME DETAILS OF THE IRELAND BUILDING.

In our article in last week's issue on the fall of a portion of the interior of the building at West Broadway and Third St., New York city, known as the Ireland building, from the name of its owner, we stated that the theory we then gave of the cause of the disaster was subject to correction on the discovery of further evidence. The defective cast iron column on the sixth floor, together with overloading by plaster bags and eccentric loading, we then believed to be the most

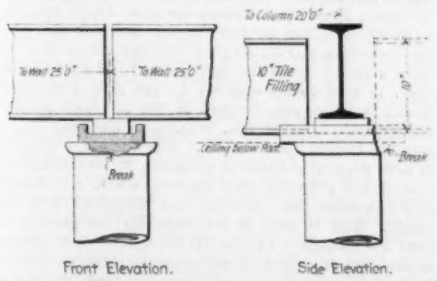


Fig. 1. Method of Supporting Roof Beams of the Ireland Building.

probable cause of the accident, and we still believe it was sufficient to explain the accident if no other defects in material, design or method of erection had been discovered. The description we gave of this cast iron column, with the sketch showing the relative thickness of the two sides and the blowholes in the thinner side failed to do it justice. More careful examination, made since our last issue, shows that it was far worse than our sketch or description would indicate.

Since our visit to the building a week ago, the debris has been completely removed from the cellar, except the standing column in the cellar, which appears to have been forced downwards about 7 ft., shearing its way through a cast iron plate 3 ins. thick, through a block of stone and a block of concrete, each a foot thick, and 5 ft. into the earth beneath. The column is left in this shape until it can be visited by the coroner's jury of experts, which is now in session taking testimony. The debris being thus cleared away, it is found that other columns besides the one that was on the sixth floor show defects fully as bad as were found in that; in fact, the column above

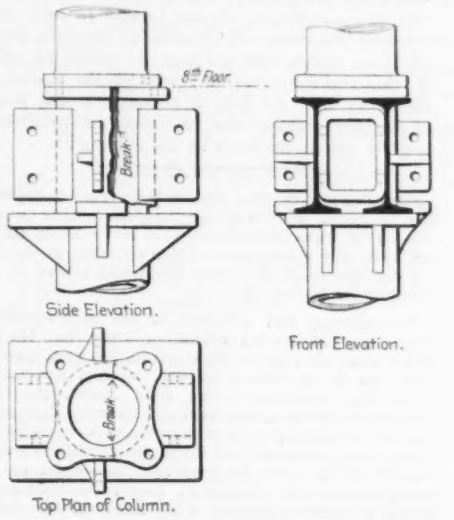


Fig. 2. Floor Beam Supports of the Ireland Building.

it on the seventh floor was, if possible, somewhat worse. The core had shifted, so that the thinner side was only ½ in. thick, and the fractured surface shows numerous blowholes, "cold shuts" and seams. There were thus at least two defective columns, either one of which might have caused the accident. There are, however, other structural defects in the ironwork of the building which may have been the immediate cause of the disaster, and are sufficient to account for it, even if the two defective columns had been perfect. Besides these there is also the possible settling of the foundation; but this cannot be proved until after it has been excavated. There being thus a variety of possible causes of the disaster, it may not be easy to determine which one of them was the exact primary cause. The non-discovery of the primary cause, however, in no way releases any of the several parties concerned in the construction of the building who may have contributed to making it unsafe from responsibility for the disaster.

Take a parallel case. Let us suppose that at a coroner's inquest after a boiler explosion it should appear that the owner bought a cheap boiler; that it was made of a poor quality of material; that the rivets were improperly spaced; that the safety valve was rusted fast; that the steam gage registered falsely; that there was evidence of low-water at some time previous to the explosion; that there was scale in the boiler; that it was externally corroded; that an official inspector had perfunctorily performed his duty and had certified the boiler as safe without proper examination, and that the fireman was inattentive and careless. In that case the culpability of the owner, the boiler-maker, the foreman of the boiler shop, the official inspector or the fireman would not be diminished because of the multiplicity of probable and sufficient causes, two or more of which might have acted conjointly to produce the disaster.

The collapse of the Ireland building appears to be similar in nearly every respect to this hypothetical boiler explosion. From the testimony already before the coroner's jury, and from the silent testimony given by the fractured columns and by the parts of the structure which still remain in place, it appears that the owner employed a cheap architect, who was paid only 1% commission on the cost of the building for his plans and superintendence; that the contractor for the structure was induced to lower his original bid about 10%, or $6,700, to obtain the work; that this contractor substituted a foundation stone of micaceous schist, or similar weak stone, for the granite called for by the specifications, and that he laid under it 12 ins. of concrete instead of 18 ins., as he agreed to do; that the contractor for the ironwork furnished columns which were of light weight, of hard and brittle iron, much thinner on one side than on the other and full of blowholes; that the roof was enormously heavy, and in addition was weighted with bags of gravel; that the plasterer piled bags of plaster one above the other on the floors of the unfinished structure; that the design of the roof beam supports was defective, in that the beams rested on supporting-plates of insufficient thickness, and were not bolted or otherwise fastened to the columns; that the architect did not efficiently superintend the construction, did not know of the existence of an old cistern in the vicinity of the foundation of the column, was not aware of the deficient thickness of the concrete bed until after the accident, and made no objection to the other defects in material or to the deficient roof support; that the city building inspector reported no faults in any of the materials or workmanship.

The coroner's jury is still in session listening to the theories of different experts as to what may have caused the disaster. Theories are therefore still in order, and we will give the experts another one to think over, not that we believe it to be more probable than the one given last week—viz., the defective column on the sixth floor—but because it has the merit of being sufficiently broad to cover several possible causes and to throw the responsibility on more than one pair of shoulders. The owner wanted a cheap building. He therefore avoided the expense of completely excavating the earth below the foundation to the bottom of the old well or cistern, and filling the space with concrete or masonry, and trusted that it would be sufficient to rest the foundation on a substratum of irregular strength—viz., the original earth or loam in one part, the loose material filled in around the old well in another, and the different material filled inside of the well in the third part. The concrete base, made 12 ins. thick instead of 18 ins. by the building contractor, and passed or not noticed by both the architect and the building inspector, resting on an insecure bottom, settled a mere trifle, cracked, and transmitted a slight tremor through the whole vertical line of nine superposed columns to the roof. The roof, heavily overweighted by the original design, probably of the architect, which was passed by the Building Department, cracked the thin plate (by which the principal roof beam was carried as by a cantilever, and not as by a plate in compression), which rested on the column between the eighth floor and the roof. This let the roof fall to the eighth floor.

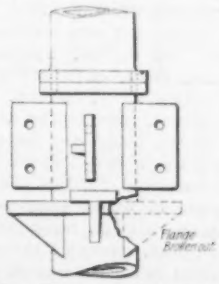


Fig. 3. Broken Flange of One of the Columns.

Had the roof been light, and had the columns below the eighth floor been strong, the falling in of a section of the roof might have been the extent of the damage. But the columns in the sixth and seventh stories were defective and weak and incapable of resisting shock, and the sixth and seventh floors were heavily loaded with plaster. The seventh floor therefore gave way, and the increased weight, with the shock of the falling material, then crashed successively through all the floors to the first, and brought a succession of pile-driver blows on the column in the cellar, causing it to plough its way through the foundation stone and concrete, and several feet into the ground be-

neath. There were thus several contributing causes to the disaster: 1, the insecure bottom; 2, the thin concrete foundation; 3, the heavy roof; 4, the additional weight of gravel on the roof; 5, the insecure support of the principal roof beam; 6, the weakness of the columns on the sixth and seventh floors; 7, the weighting of these floors with bags of plaster.

We now leave the theories and proceed to discuss some of the facts shown in the details of the construction. We have already spoken of the thinness of the concrete foundation block, and of the imperfection of some of the cast iron columns. The next detail that attracts our attention is the construction of the roof. As shown in the sketch of the ground plan of the building, given in last week's issue, there were four vertical rows of cast iron columns in the center of the building, which, with the end walls, divided the whole area into five bays of 20 × 50 ft. The principal floor girders, each composed of two I-beams, ran in a row from one column to another, dividing each bay into two sections of 20 × 25 ft. Each section was then subdivided into four smaller sections, 5 × 25 ft., by single I-beams. The construction of the roof was similar to that of the floors, except that a single 10-in. I-beam was used for a principal girder instead of a pair of beams. The method of supporting this principal girder on the roof is shown in the cut, Fig. 1. Instead of a flange on the top of the 8-in. column, there is a mere bead about 1 in. thick. On top of this, without fastening of any kind, rested a thin, flat, cast iron plate, about 6 ins. wide by ¾ in. thick, with a flange ¾ in. high on each side. This plate projected about 2 ins. beyond the bead on each side of the column. On each end of this plate the end of one of the I-beams of the principal girder rested, without fastening of any kind, and in such a manner that its weight may have been brought entirely on the overhanging part of the plate. In any event, its end was not brought directly over any part of the column, except the narrow bead. It is easily seen that if there was a slight warping of the plate or of the beam, or of both, the weight of the beam may have been brought on the extreme end of the overhanging plate, instead of on a point immediately above the bead, and in that case the plate would be liable to fracture by transverse strain. If, however, the beam rested at a point 2 ins. from the end, the plate would be subject to shearing strain. Had the resting point been directly above the metal of the column itself, the metal of the plate would have been under direct compression, and in that case it is difficult to see how the plate could have been fractured at all. But the plate was fractured, as is shown in the accompanying cut, which is drawn from one of the columns still standing, adjacent to the part which fell, and a very small part of the bead on the column was fractured also.

Resting on the cast iron plate in its center, directly above the column, was a blocking piece about 1¼ ins. thick, on which two of the 8-in. transverse beams rested directly, their ends coming near together, directly over the center of the column. These transverse beams, which sustained only a small part of the weight of the roof, were thus sustained by the blocking piece and the thin plate in direct compression, while the principal girder—a 10-in. beam—sustaining a very much greater load, rested on the end of the plate above described in such a way as to tend to cause it to fracture by transverse strain or by shearing.

The roof itself was composed of this framing of steel beams, filled in, like the floor, with hollow, fireproof tiling, and covered with the extraordinary thickness of about 10 ins. of what appears to be a concrete of gravel, with an upper surface of the ordinary tar gravel roof covering. We may possibly be mistaken about the dimensions of this roofing material, since the inspection made by our representative was made from the eighth floor at a distance from it of 40 ft., the width of the chasm made by the collapse. In any event, it was an enormously heavy roof, and the supporting of it in the flimsy manner shown in the cuts is one of the worst features of the whole construction.

The support of the floor beams on the cast iron columns was the ordinary one, as shown in Figs. 2 and 3. The principal girder, of double I-beams, was carried on heavy flanges with corbels underneath, and the beams were also fastened to the columns by two bolts passing through projecting lugs. The single transverse I-beams which rested on the columns were also carried on flanges, and secured by a single bolt to a projecting lug. The flanged beam supports and lugs of these columns, which are frequently a weak point in cast iron column construction, do not appear to have been weak in this case. The method of fracture of one of them, which fracture was no doubt an effect of the accident, and not one of its causes, is shown in Fig. 2. Fig. 3 shows how the flange of another column was fractured, by being torn entirely out of the body of the column.

According to a recently enacted law, seriously obstructing the track of railways or the public mails is punishable by death in Mexico. This law is being rigidly enforced, and a man and a boy were recently shot for causing the wreck of a train by placing stones on the track of the Hidalgo Ry.

The masonry and cribwork of the new Speedway drive, on the portion extending along the Harlem River from 155th St. to High Bridge, has been severely criticised by Mr. Foster Crowell, M. Am. Soc. C. E., Consulting Engineer of the Park Board. He finds settlement cracks in the walls and so much damage to one of the subway arches that it may have to be rebuilt. For a distance of about 500 ft. the cribwork foundation has been distorted and pushed out by the filling behind. Mr. James D. Leary, the contractor, denies any serious damage to the masonry, but admits that the cribwork is defective and should be rebuilt. Mr. Leary, however, blames the engineer of the old Park Department for this. He says that this cribwork was to be originally 18 ft. deep; but the discovery of a peat stratum beneath made it necessary to go down 38 ft. with the same 20 ft. width as proposed for the 18 ft. depth. As the contractor was paid by the cubic foot it would have been to his advantage to widen the crib. But the engineer gave no such orders, and the trouble seems to have been the lack of information as to the depth of the peat bog before the crib was started. As Mr. Kellogg, who designed the work, was called to other duty and the "Speedway" work was placed in charge of his first assistant, Mr. C. H. Graham, who was made "Assistant Engineer in Charge," the question of responsibility is a mooted one. As before mentioned, the trouble seems to have arisen from a lack of full previous investigation into the character of the foundation soil at this point, rather than from any faulty design. Who was responsible for this investigation was not stated. Mr. Calvert Vaux, the landscape architect, appointed by the Park Board, criticises the plans for the steep incline between 155th and 160th Sts. The old specifications called for a top dressing of loam on the roadway at this point. As Mr. Vaux pointed out, this dressing would be washed to the foot of the hill in a short time, and he proposes a Telford pavement, such as is used on the Morningside driveway. Mr. Vaux also recommends a 10-ft. free space on each side of the driveway for ornamentation. Under the old plan the roadway was to be 100 ft. wide with 25-ft. walks on each side. Under the new plan the road would be 90 ft. wide with 20-ft. sidewalks and a 10-ft. free space between the road and the walks on each side.

The contract for the erection of a lift bridge over Newtown Creek between Brooklyn and Long Island City, which we stated in last week's issue had been awarded by the Supervisors of Kings and Queens counties to the King Bridge Co., of Cleveland, for $418,000, has been vetoed by the Supervisor-at-Large of Kings County, on the ground that the amount of the bid was excessive, being over $100,000 in advance of the engineer's estimates.

The New East River Bridge Commission is in receipt of further propositions from the owners of the old East River Bridge Company's franchise, represented by Messrs. Uhlman and Lauterbach. The old company proposes to sell all its rights under the franchise for $125,000 and the right to run trains over the bridge to be built; or it will dispose of these rights for $250,000 without the right to run trains. The present Commission admits that the East River Bridge Company has a valid charter, but says that it is authorized to build a bridge and has no right to grant exclusive privileges for its use to any party. The old company claims that it has value in its acquired rights to operate a railway over the bridge its charter permitted it to build, and it wants some return for the surrender of this right to the public. It is difficult to understand how the rights of the old company can in any way interfere with the progress of the new and entirely distinct bridge. The East River Bridge Company simply failed to carry out its project; and unless it makes its claim much more clear to the public than it has yet done, this public is justified in looking upon its present efforts simply as a cheeky attempt to regain money lost in an unsuccessful business venture.

The Louisville and Jeffersonville railway bridge across the Ohio River was opened to traffic on Aug. 17. This bridge company was incorporated in 1887; the contract was let to the Phoenixville Bridge Co., and work was commenced on Oct. 12, 1889. There were many delays, owing to changes in ownership and the financial condition of the country. The bridge is now owned by the Big Four and Chesapeake & Ohio railways. With its approaches the bridge is about two miles long, but the bridge proper is 2,745 ft. in length, with six spans ranging from 553 ft. to 210 ft. The original estimate of cost was $2,325,000.

The Jersey City water bids are to be submitted to an expert engineer employed by the Finance Board before that body takes action on the award of the contract to the Jersey City Water Co., made on Aug. 12 by the Street and Water Commissioners, as noted last week.

The city of Danbury, Conn., has been enjoined from discharging its sewage into Still River after May 1, 1897, notwithstanding the fact that the sewage is being treated by the Woolf disinfecting process. This process was described in our issue of July 13, 1893. It consists in dosing the sewage with sodium hypochlorite formed by the partial electrical decomposition of a solution of salt and water. The court recommends intermittent filtration, and adjudges costs against the city. An appeal will be taken to the higher courts of the state.

The Lake Superior Power Co., with a capital of $2,000,000, has been organized by a Philadelphia syndicate, with Mr. F. H. Clergue as President, to further develop power on the Sault Ste. Marie Canal. The new company has secured options on additional right of way, and proposes to develop 50,000 HP., and to erect the largest pulp mill in the country, a paper mill of 100 tons daily capacity, and a sulphite fiber works. The company controls a Canadian timber grant covering 640,000 acres, covered with spruce, which can be imported free of duty.

Eastern cities have been slow to follow the example of Western cities in the use of brick paving; but from present indications a large market for paving brick will yet be found in New York and New England. Newark and Brooklyn are each advertising this week for several blocks of brick paving, and the results obtained on these streets will be carefully watched.

A project for improved railway facilities for Ottawa, Ont., has been planned, and a part of the work is already being carried out. The Canadian Pacific Ry. has a dead-end terminal station at some distance from the business part of the city, and through trains have either to head in, and then go out in reversed position, or else run past the station and then back in. The plan is to build a bridge across the Ottawa River at Nepean Point, just below the Government buildings and the mouth of the Rideau Canal, and to connect it at one end with the Canadian Pacific Ry. near Hull, on the Quebec side of the river, and at the other end with a line running parallel with the canal to a central union station between the Maria St. and Sparke St. bridges. From this station the line would run to the existing terminus of the Canada Atlantic Ry. and to the Canadian Pacific Ry., so that the latter line would have a direct route through the city. This road, however, is said to be opposed to the new arrangement, which is being put forward in the interests mainly of the Canada Atlantic Ry., Ottawa & Gatineau Ry. and Pontiac Pacific Junction Ry. The Canada Atlantic Ry. is now grading a roadbed along the Rideau canal to the site of the proposed new station, which will considerably increase its facilities for Montreal and other traffic. The Ottawa & Gatineau Ry. at present runs over the Canadian Pacific Ry. from Hull to Ottawa, but is desirous of obtaining independent terminal facilities. It is of interest to note that borings made for the new bridge show a depth of 63 ft. of sawdust just at Nepean Point, which is an indication of the serious effects of allowing the mills to throw the sawdust into the river.

Gen. Wm. P. Craighill, the new Chief of Engineers, proposes to change the plan of sending engineer graduates of West Point to the Engineer School at Willets Point for a further three years' course. Gen. Craighill believes that this time could be spent more profitably by a direct assignment to duty under experienced engineer officers in various parts of the country. This latter plan is to be adopted, by order of the Secretary of War, and it seems a very sensible one for the actual instruction required.

The deepest boring below sea-level is claimed to be a well recently finished at Parochowice, in Silesia. The boring commences with a diameter of 24 ins., and the hole is 6,522 ft. deep.

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PERSONALS.

Mr. John L. Harrington, Superintendent of the Cambridge, Mass., Water Works, died on Aug. 16.

Mr. Lloyd S. Earle, a wealthy contractor of Fall River, Mass., died on Aug. 11, aged 83 years.

Mr. George T. Prince has been appointed Superintendent of the Water Works of Atlantic City, N. J.

Mr. A. J. Hitt has been appointed Superintendent of the Chicago, Rock Island & Pacific Ry., vice Mr. Charles Dunlap, deceased.

Mr. Arnold Erach, Ph. D., has been added to the engineering faculty of the University of Kansas, as Assistant Professor of Graphics.

Mr. G. B. Fox, Chief Engineer of the Gila Valley, Globe & Northern Ry., died recently at Holladay's Hot Springs, Cal., of typhoid fever.

Mr. Charles Bogan, a topographical engineer, in the service of the U. S. Geological Survey for eight years, died in Washington, D. C., on Aug. 11.

Mr. John Schuyler, who was for a number of years Chief Engineer of the New York, New Haven & Hartford R. R., died on Aug. 19 in the 66th year of his age.

Mr. J. F. Bigelow has been elected city engineer of Marlborough, Mass., vice Mr. B. R. Felton, Assoc. M. Am. Soc. C. E., whose resignation was tendered in April.

Mr. Edwin C. Brooks has been appointed Superintendent pro tem. of the Cambridge (Mass.), Water Works, pending the election of a new superintendent to fill the vacancy caused by the death of Mr. John L. Harrington.

Mr. George L. Davis, of Grand Rapids, Mich., has been engaged as Chief Engineer and Superintendent of Construction of the Bayfield & Western R. R., which is about to be built from Bayfield to Washburn, Wis., and later extended to St. Paul, Minn., via Iron River, Wis.

Mr. Eli Whitney, son of the inventor of the cotton gin, died in Sharon, Conn., on Aug. 17, aged 75 years. He made many improvements in cotton machinery, and in 1861 he, with another contractor, began the construction of the water-works at Lake Whitney for supplying New Haven.

Major P. H. Thomson, C. E., until recently Superintendent of Construction for the Seventh and Eighth Lighthouse districts, has been placed in charge of the construction of the great lock which the government will build at Plaquemine, La., on the canal which is to connect the Mississippi and the Atchafalaya Rivers.

Major Conway Robinson Howard died at the Johns Hopkins Hospital in Baltimore, on Aug. 2. He had been connected with many important engineering works, notably the building of the Chesapeake & Ohio R. R., and the Philadelphia extension of the Baltimore & Ohio R. R. For three years he had been engaged on the topographical survey of the city of Baltimore.

The retirement of Gen. Henry L. Abbott, of the Corps of Engineers, U. S. A., changes the details and duties of the following officers: Col. H. M. Robert, division engineer of Southwest Division, becomes President of the Board of Engineers; Col. J. M. Wilson, in charge of the public buildings and grounds in Washington, becomes division engineer of the Northeast Division, with station at New York, and Col. Peter C. Haines becomes a member of the Board of Ordnance and Fortifications.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

AMER. ASS'N FOR THE ADVANCEMENT OF SCIENCE.
Aug. 28 to Sept. 7. At Springfield, Mass. Secy., F. W. Putnam, Salem, Mass. Local Secy., Wm. A. Webster, Springfield, Mass.

SOCIETY FOR PROMOTION ENGINEERING EDUCATION.
Sept. 2, 3 and 4. At Springfield, Mass. Secy., J. B. Johnson, Washington University, St. Louis, Mo.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 11 to 13. At Burlington, Vt. Secy., John C. Whitney, Newton, Mass.

NATIONAL IRRIGATION CONGRESS.
Sept. 16 to 19. At Albuquerque, N. Mex. Secy., Fred L. Ailes, Los Angeles, Cal.

AMERICAN SOCIETY OF IRRIGATION ENGINEERS.
Sept. 16 to 19. At Albuquerque, N. Mex. Secy., John S. Titcomb, Denver, Colo.

NEW ENGLAND ROADMASTERS' ASSOCIATION.
Sept. 18, 19. At the Revere House, Boston, Mass. Secy., M. C. Hamilton, Hartford, Conn.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 8. At Atlanta, Ga. Secy., R. W. Raymond, New York, N. Y.

ROADMASTERS' ASSOCIATION OF AMERICA.
Oct. 8. At St. Louis, Mo. Secy., W. W. Sharpe, Waycross, Ga.

AMERICAN INT. ASSOC. OF RY. SUPTS. OF BRIDGES AND BUILDINGS.
Oct. 15. At New Orleans, La. Secy., S. F. Patterson, Boston & Maine R. R.; Concord, N. H.

AMERICAN STREET RAILWAY ASSOCIATION.
Oct. 15. At Montreal, Que. Secy., John N. Partridge, Brooklyn, N. Y.

NEW PUBLICATIONS.

TRANSACTIONS OF THE ASSOCIATION OF CIVIL ENGINEERS OF CORNELL UNIVERSITY.—Published by the Association, Ithaca, N. Y. Secy., Prof. C. L. Crandall. Paper; 8vo; pp. 128; illustrated.

This is the third volume of the Transactions, and contains the following lectures, delivered by non-resident lecturers: "The Decimal System of Measures and Its History," Prof. James H. Gore; "Notes on the Construction and Maintenance of Water-Works in Small Towns," James Owen, M. Am. Soc. C. E.; "Details of Construction of Engineering Structures," C. C. Schneider, M. Am. Soc. C. E.; "Notes on the Design and Construction of Masonry Dams," George W. Rafter, M. Am. Soc. C. E.; "Restriction of Immigration," Gen. Francis A. Walker; "The Sanitary District of Chicago," Isham Randolph; "The City and the Engineer," Robert E. McMath. The volume contains also a paper on "Measurements of the Flow of Water in a 1-in. Pipe by Means of the Pitot Tube," by W. H. Ledger, and the constitution, list of members, etc., of the Association.

OUTING TRIPS AND TOURS.—A Guide to Summer Pleasure Trips and Excursion Routes and Resorts. Supplement to Bullinger's Monitor Guide. E. W. Bullinger, 75 Fulton St., New York. 8vo; paper; pp. 120; illustrated; 10 cts.

It would be difficult indeed to make anything entirely novel in summer resort guide-book literature; but this neat little pamphlet comes as near being original as anything we have seen. It is for New Yorkers only, a fact which should appear more prominently in title page or preface, and its purpose is to tell the said New Yorker in what a multitude of different directions he can find fresh air, beautiful scenery and rest from care and turmoil at a very small expenditure of time and of money. There are few inhabitants of New York who know by experience all the different routes within a radius of fifty miles of the City Hall by which one may travel and find summer pleasures. This little pamphlet will help many, we hope, to a new realization of the opportunities for country recreation that are on every hand. The editors are to be especially congratulated on the illustrations of the work. So much of the "General Passenger Agent" literature is filled with cheap and muddy half-tones that it is a pleasure to find those in this book so well chosen and executed.

THE RAILWAYS OF INDIA. Administration Report for 1894-95.—By Lieut.-Col. T. Gracey, R. E., Officiating Director General of Railways, Calcutta. Paper; 4to; pp. 300, with map.

This report is issued with commendable promptness, many of its statistics being for the year ending March 31, 1895, and the others being for the year ending Dec. 31, 1894. It shows that in March there were 18,855 miles of railway open for traffic and 2,217 miles under construction or sanctioned. The operating expenses amounted to 46.98% of the gross earnings, and the statistics of passenger and freight traffic show an improvement over those of the former year. Details are given of construction and maintenance work carried out on the various lines, together with particulars of lines under survey or projected, among the latter of which are two projects for railway communication with Ceylon. The financial returns and statistics are given at considerable length, mainly in tabular form. The number of employees is 270,595, of whom 4,703 are Europeans. There are 2,667 railway stations, 3,949 locomotives, 11,382 cars in passenger service, 73,291 freight cars, 3,104 brake vans or cabooses, and 366 cranes, or 88,043 vehicles in all. During 1894 59 passengers were killed and 265 were injured, 193 employees were killed and 531 injured, and 381 other persons were killed and 133 injured, making a total of 633 persons killed and 929 injured.

AUGUST MAGAZINES.—Light fiction occupies the space in the midsummer magazines to the exclusion of nearly everything of even remote technical interest. One of these pieces of light fiction in Scribner's, however, can claim a word here, as it is a story of the great Railway Union strike of 1894. "The Scab" is the story's title, and an unusually well-told story it is. Theodore Roosevelt has a most excellent account in the same magazine of "Six Years of Civil Service Reform," a subject on which there is no better authority.

In "Harper's," Frederic Remington writes on the "Cracker Cowboys of Florida," and describes a region where regard for law and order seems to be at as low an ebb as anywhere in the wild and woolly West. The railways which run through this district have to pay exorbitant prices for stock killed by trains. In case of refusal, the cowboys shot at passing trains on dark nights, and even at the railway officials, by way of revenge, until the companies created the office of "cow attorney," whose duty it is to settle damage claims as best he can.

In "The Forum," E. V. Smalley writes on the "Deep Waterways Problem," explaining the desire of the Northwest for a deep waterway from the Great Lakes to the Atlantic. The article contains numerous fallacies which we may take space at another time to explain. "The Review of Reviews" has an interesting account of the clearing up and renovation of Mulberry Bend, one of the worst of New York's slums, from the pen of Jacob Riis. The article may give some hints to any engineer consulted as to the proper methods for pursuing similar reform work in other cities. In the "Popular Science Monthly" is an account of the development of fire extinguishing apparatus. The article is the first of a series, and is devoted chiefly to the development of the modern fire engine. In the "North American Review," Worthington C. Ford, Chief of the Bureau of Statistics, writes on "The Turning of the Tide," of business prosperity. Hon. Wm. McAdoo takes up again the possibilities in the use of private yachts as naval auxiliary vessels.

TRADE PUBLICATIONS.

FIREPROOF CONSTRUCTION.—New Jersey Wire Cloth Co., Trenton, N. J., and 117 Liberty St., New York. Paper; 10¾ × 7 ins.; pp. 8; illustrated.

This system of construction, known as the Roebling system, consists of a combination of concrete and wire netting for floor arches and partitions. It was described and illustrated in our issue of July 18.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Aug. 23.	Grading,	Des Moines, Ia.	Aug. 15
Aug. 23.	U. S. public building	at Savannah, Ga.	Aug. 8
Aug. 23.	Brick paving,	Des Moines, Ia.	Aug. 15
Aug. 23.	Lay'g water mains (20 sts.),	New York.	Aug. 15
Aug. 23.	Granite block paving,	New York.	Aug. 15
Aug. 23.	Asphalt paving,	New York, N. Y.	Aug. 15
Aug. 23.	Sewer,	Rochester, N. Y.	Aug. 15
Aug. 23.	Brick paving,	Rochester, N. Y.	Aug. 15
Aug. 23.	Sewers,	Chicago, Ill.	Aug. 15
Aug. 23.	Sea wall,	Revere, Mass.	Aug. 22
Aug. 24.	Water-works materials,	Jasper, Ind.	Aug. 8
Aug. 24.	Plans school bldg.,	New Whatcom, W'n.	Aug. 8
Aug. 24.	Water bonds ($23,000),	Casper, Wyo.	Aug. 15
Aug. 24.	Road improvements,	Cincinnati, O.	Aug. 15
Aug. 24.	Water bonds,	Warren, Ill.	Aug. 15
Aug. 24.	Grading,	Washington, D. C.	Aug. 22
Aug. 24.	Improving streets,	Zanesville, O.	Aug. 22
Aug. 24.	Brick paving,	White Plains, N. Y.	Aug. 22
Aug. 24.	Macadamizing,	Leicester, Mass.	Aug. 22
Aug. 24.	Pipe sewers,	Leicester, Mass.	Aug. 22
Aug. 24.	Pipe sewers,	Elkhorn, Wis.	Aug. 22
Aug. 24.	School bldg. plan,	Binghamton, N. Y.	Aug. 22
Aug. 24.	Rock excavation,	Lafayette, Ore.	Aug. 22
Aug. 25.	Plans hospital building,	Bangor, Me.	Aug. 15
Aug. 26.	Hospital buildings,	Bangor, Me.	July 25
Aug. 26.	Electric lighting,	Collinwood, O.	Aug. 1
Aug. 26.	Brick paving,	Michigan City, Ind.	Aug. 15
Aug. 26.	Macadamizing,	Yonkers, N. Y.	Aug. 15
Aug. 26.	Macadamizing,	Mount Vernon, N. Y.	Aug. 15
Aug. 26.	Paving,	Syracuse, N. Y.	Aug. 15
Aug. 26.	Water bonds ($90,000),	Pittsfield, Mass.	Aug. 15
Aug. 26.	Brick sewer,	South Bend, Ind.	Aug. 15
Aug. 26.	Hospital building,	Quincy, Ill.	Aug. 22
Aug. 26.	Pipe sewers,	Edgewood, Pa.	Aug. 22
Aug. 26.	Fire engine houses (3),	Detroit, Mich.	Aug. 22
Aug. 26.	Plumbing and heating,	Hampton, Va.	Aug. 22
Aug. 26.	Iron bridges (2),	Camden, N. J.	Aug. 22
Aug. 26.	Sewers,	Kansas City, Kan.	Aug. 22
Aug. 26.	Paving,	Kansas City, Mo.	Aug. 22
Aug. 26.	Medina block paving,	Elmira, N. Y.	Aug. 22
Aug. 26.	Conductors and cables,	Buffalo, N. Y.	Aug. 22
Aug. 26.	School building,	New Kensington, Pa.	Aug. 22
Aug. 26.	Steel piers (3),	Chippewa Falls, Wis.	Aug. 22
Aug. 26.	Stone arch bridge,	Syracuse, N. Y.	Aug. 22
Aug. 26.	Iron bridges (5),	Beatrice, Neb.	Aug. 22
Aug. 26.	Plumbing, etc.,	Rochester, N. Y.	Aug. 22
Aug. 27.	Supplies for Mare Island navy yard.		Aug. 8
Aug. 27.	Brick paving,	Jersey City, N. J.	Aug. 15
Aug. 27.	Granolithic paving,	Jersey City, N. J.	Aug. 15
Aug. 27.	Water-works system,	Remsen, Ia.	Aug. 15
Aug. 27.	Plumbing, etc.,	Detroit, Mich.	Aug. 15
Aug. 27.	Rebuilding beacon near	Elizabethport.	Aug. 15
Aug. 27.	Pipe sewers,	Mechanicsville, N. Y.	Aug. 15
	Advertised, Eng. News, Aug. 15.		
Aug. 27.	Sewer,	Port Richmond, N. Y.	Aug. 15
Aug. 27.	Steel pipe sewer,	Jersey City, N. J.	Aug. 15
Aug. 27.	Viaduct,	Jersey City, N. J.	Aug. 15
Aug. 27.	Bridges (2),	Stanton, Neb.	Aug. 15

Aug. 27. Pipe sewer, Valparaiso, Ind.....Aug. 15
Aug. 27. Jail, etc., New Kensington, Pa.....Aug. 15
Aug. 27. Heating & ventilating, Detroit, Mich..Aug. 15
Aug. 27. Cobblestone paving, Brooklyn, N. Y...Aug. 22
Aug. 27. Improving streets, Oxford, O.....Aug. 22
Aug. 27. Paving, New York, N. Y.....Aug. 22
Aug. 27. Grading and paving, Philadelphia, Pa..Aug. 22
Aug. 27. Dredging (400,000 cu.yds.), New York..Aug. 22
Aug. 27. Pier work, etc., New York, N. Y.....Aug. 22
Aug. 27. Brick sewers, Indianapolis, Ind.....Aug. 22
Aug. 27. Cement sidewalks, etc., Indianapolis..Aug. 22
Aug. 27. Electric ry. (12 miles), Pottsville, Pa...Aug. 22
Aug. 27. Heating apparatus, St. Johns, N. B...Aug. 22
Aug. 28. Water-works system, Sigourney, Ia...Aug. 8
Advertised, Eng. News, Aug. 8 and 15.
Aug. 28. Brick paving, Cincinnati, O.....Aug. 15
Aug. 28. Brick sewers, Williamsport, Pa.....Aug. 22
Advertised, Eng. News, Aug. 22.
Aug. 28. Sewers, Evanston, O. .....Aug. 22
Aug. 28. Pipe sewers, Williamsport, Pa.....Aug. 22
Advertised, Eng. News, Aug. 22.
Aug. 28. Paving, Williamsport, Pa.....Aug. 22
Advertised, Eng. News, Aug. 22.
Aug. 28. Gas pipe, etc., Philadelphia, Pa.....Aug. 22
Aug. 28. Repairing building, Baltimore, Md....Aug. 22
Aug. 28. City hall, Havana, Ill. .....Aug. 22
Aug. 28. Pile sewer outlet, Chicago, Ill.....Aug. 22
Aug. 28. Sewers, Washington, D. C.....Aug. 22
Advertised, Eng. News, Aug. 22.
Aug. 28. Garbage disposal, Denver, Colo.....Aug. 22
Aug. 29. Asylum building, Bolivar, Tenn.....Aug. 8
Aug. 29. Road, Troy, O. .....Aug. 15
Aug. 29. Paving, Dayton, O.....Aug. 15
Aug. 29. Water-wks. system, Naples, N. Y....Aug. 15
Advertised, Eng. News, Aug. 15 and 22.
Aug. 29. Signal tower, Cape Arago, Ore.....Aug. 15
Aug. 29. Brick pvg. (28,300 sq.yds.), Newark, N. J.Aug. 22
Advertised, Eng. News, Aug. 22.
Aug. 29. Water pipe, Lowell, Mass. .....Aug. 22
Advertised, Eng. News, Aug. 22.
Aug. 30. Timber (60 sq. miles), Ottawa, Ont....July 11
Aug. 30. Plans for school bldg., Buffalo, N. Y..Aug. 1
Aug. 30. Sewers, Elizabeth, N. J.....Aug. 15
Aug. 30. Pipe sewers, Buffalo, N. Y.....Aug. 15
Aug. 30. Asphalt paving, Brooklyn, N. Y.....Aug. 22
Aug. 30. Grading, etc., New York, N. Y.....Aug. 22
Aug. 30. Brick paving (27 streets), Louisville, Ky.Aug. 22
Aug. 30. Pumping engine, Buffalo, N. Y.....Aug. 22
Aug. 30. Lay'g water mains (20 Sts.), New York.Aug. 22
Aug. 30. School building, Buffalo, N. Y.....Aug. 22
Aug. 30. Artificial stone sidewalks, Elora, Ont...Aug. 22
Aug. 30. Asphalt paving, Brooklyn, N. Y.....Aug. 22
Aug. 30. Fire alarm boxes (100), Brooklyn, N. Y.Aug. 22
Aug. 31. Grading, Omaha, Neb.....Aug. 15
Aug. 31. Plumbing, Boston, Mass.....Aug. 22
Aug. 31. Water bonds, Marlette, Mich.....Aug. 22
Aug. 31. Water-works system, Lancaster, Wis..Aug. 22
Advertised, Eng. News, Aug. 22.
Aug. 31. Sidewalks, Indianapolis, Ind.....Aug. 22
Sept. 2. Electric light plant, Canton, Miss.....July 25
Advertised, Eng. News, July 25 and Aug. 1.
Sept. 2. Water-works system, Canton, Miss....July 25
Advertised, Eng. News, July 25 and Aug. 1.
Sept. 2. Water-works franchise, Canton, Miss..July 25
Advertised, Eng. News, July 25 and Aug. 1.
Sept. 2. Electric lighting, Hempstead, N. Y...Aug. 8
Advertised, Eng. News, Aug. 8.
Sept. 2. Water-works system, Millersburg, O..Aug. 8
Advertised, Eng. News, Aug. 8 to 22.
Sept. 2. Bridge, Olivet, S. Dak.....Aug. 8
Sept. 2. Court house, Lumpkin, Ga.....Aug. 15
Sept. 2. Water-works system, Columbiana, O..Aug. 15
Sept. 2. Court house work, Columbus, Ga.....Aug. 15
Sept. 2. Heating and ventilating, Cincinnati, O.Aug. 15
Sept. 2. Brick paving, Logansport, Ind.....Aug. 22
Sept. 2. Brick paving, Pleasant Ridge, O. ....Aug. 22
Sept. 2. Pipe, hydrants, etc., Youngstown, O....Aug. 22
Advertised, Eng. News, Aug. 22.
Sept. 2. Wooden bridges, Brookings, S. Dak....Aug. 22
Sept. 2. Street lighting, Seneca Falls, N. Y....Aug. 22
Sept. 2. Wooden bridges (2), Aitkin, Minn.....Aug. 22
Sept. 2. Steel drawbridge, Zanesville, O.....Aug. 22
Sept. 2. Highway bridge, Seattle, Wash.....Aug. 22
Sept. 3. Prison labor to let, Michigan City, Ind.Aug. 1
Sept. 3. Levee work, Greenville, Miss.....Aug. 8
Sept. 3. Water supply, Camden, N. J.....Aug. 15
Advertised, Eng. News, Aug. 15.
Sept. 3. Water-works system, Warren, Ill.....Aug. 15
Advertised, Eng. News, Aug. 15 and 22.
Sept. 3. Macadamizing, etc., Stapleton, N. Y...Aug. 22
Advertised, Eng. News, Aug. 22 and 29.
Sept. 3. Bridge, Madison, Ind. .....Aug. 22
Sept. 3. Steel highway bridge, Stapleton, N. Y..Aug. 22
Advertised, Eng. News, Aug. 22 and 29.
Sept. 3. Wooden trestle, Stapleton, N. Y.....Aug. 22
Advertised, Eng. News, Aug. 22 and 29.
Sept. 3. Intake pipe, Evansville, Ind.....Aug. 22
Advertised, Eng. News, Aug. 22.
Sept. 3. Pump well, etc., Evansville, Ind.....Aug. 22
Advertised, Eng. News, Aug. 22.
Sept. 3. Paving, Syracuse, N. Y.....Aug. 22
Sept. 4. Electric light plant, Blackwood, N. J...Aug. 15
Sept. 4. Brick pvg (26,000 sq. yds.), Olean, N. Y..Aug. 22
Advertised, Eng. News, Aug. 22 and 29.
Sept. 4. Brick paving, Brooklyn, N. Y.....Aug. 22
Sept. 4. Iron bridge, Toledo, Ia.....Aug. 22
Sept. 4. Iron or steel bridge, Marengo, Ia.....Aug. 22
Sept. 4. Sewage pumping sta. Providence, R. I.Aug. 22
Sept. 4. School building, Baltimore, Md.....Aug. 22
Sept. 4. Brick paving, Brooklyn, N. Y.....Aug. 22
Advertised, Eng. News, Aug. 22.
Sept. 5. State capitol plans, St. Paul, Minn....July 11
Sept. 5. Stone sidewalks, Cincinnati, O.....Aug. 22
Sept. 5. Grading, Omaha, Neb.....Aug. 22
Sept. 5. Brick chimney, Hoboken, N. J.....Aug. 22
Sept. 6. Court house, South Bend, Ind.....July 25
Sept. 6. Removing shoals (4), Detroit, Mich...Aug. 8
Advertised, Eng. News, Aug. 8 to 29.
Sept. 6. Electric traveling crane, St. Louis,....Aug. 22
Sept. 7. Paving (13,600 sq. yds.), De Kalb, Ill..Aug. 22
Advertised, Eng. News, Aug. 22 and 29.
Sept. 9. Dredging, Washington, D. C.....Aug. 15
Advertised, Eng. News, Aug. 15 to Sept. 5.
Sept. 9. Hospital building, San Antonio, Tex...Aug. 22
Sept. 9. Heating and plumbing, Des Moines, Ia..Aug. 22
Sept. 10. Plans for city hall, Worcester, Mass...July 18
Sept. 10. Water-wks system, Grand Junction, Colo.Aug. 1
Advertised, Eng. News, July 18 to Aug. 8.
Sept. 10. Laying water pipe, Brooklyn, N. Y...Aug. 15
Advertised, Eng. News, Aug. 15.
Sept. 10. Pipe sewers (105,000 ft.), St. Louis, Mo.Aug. 22
Sept. 10. Brick sewers (30,000 ft.), St. Louis, Mo.Aug. 22
Sept. 11. Improving streets, Evanston, O.....Aug. 22
Sept. 11. Brick school building, Independence, O.Aug. 22
Sept. 11. Water main, Lakewood, O.....Aug. 22
Sept. 12. Plumbing, etc., Fort Worth, Tex.....Aug. 22
Sept. 13. Cement, castings, etc., Washington..Aug. 15
Advertised, Eng. News, Aug. 15 to Sept. 5.
Sept. 13. Plumbing, etc., Philadelphia, Pa.....Aug. 15
Sept. 14. Plans for library bldg., Madison, Wis..July 18
Sept. 15. Electric railway, Cleveland, O.....Aug. 22
Sept. 16. Pumping engines, Youngstown, O.....Aug. 22
Advertised, Eng. News, Aug. 22.
Sept. 17. Water-works franchise, Rushville, Ind.Aug. 15
Advertised, Eng. News, Aug. 8 to 22.
Sept. 17. Water-wks system, Armstrong, Ia....Aug. 22
Advertised, Eng. News, Aug. 22.
Sept. 17. Removal of wreck, Washington, D. C.Aug. 22
Sept. 18. Water-wks. franchise, Butte, Mont....July 11
Advertised, Eng. News, July 11 to Aug. 8.
Sept. 19. Sale of dredge, etc., Newport, R. I.....Aug. 22
Advertised, Eng. News, Aug. 22 to Sept. 12.
Sept. 20. Steel supports, etc., Chicago, Ill.....Aug. 22
Oct. 1. Plans for art building, Philadelphia, Pa..May 23
Advertised, Eng. News, May 23 to June 27.
Oct. 1. Composite gunboats, Washington, D. C.Aug. 1
Oct. 9. Sale of canal, Annapolis, Md.....Aug. 22
Nov. 1. Plans school building, Pittsburg, Pa...Aug. 8
No date. Doors (600), New Orleans, La.....Aug. 22
Advertised, Eng. News, Aug. 22 and 29.
" .Stand-pipe, Kennett Square, Pa.....Aug. 22
" .Electric r'y materials, Springfield...Aug. 22
" .Highway bridge, Webster, W. Va.....Aug. 22
" .Street lighting, Ingersoll, Ont.....Aug. 22
" .Plans for court house, Center, Ala.....Aug. 22

RAILWAYS.

East of Chicago.

ALLEGHENY & CHARTIERS.—Incorporated in Pennsylvania Aug. 15 to build a steam railway from Esplen borough to Allegheny City; capital stock, $15,000; Pres., Geo. H. Brown; directors, W. D. Uptegraff and T. W. Sieman, all of Pittsburg, Pa.

CANADA ATLANTIC.—This road has a steam shovel at work widening one side of the cut of the Rideau Canal in Ottawa to form a roadbed for a line alongside the canal to the proposed new central station near the head of the locks. A part of the project is a further extension along by the locks to Nepean Point, where a bridge would cross the Ottawa River, thus giving a better route into Ottawa, and a more central site for the station than the present dead-end terminal station of the Canadian Pacific Ry. The new project is in the interests of the Canada Atlantic, Ottawa & Gatineau Valley and Pontiac Pacific Junction railways, but if carried out, would also probably be used by the Canadian Pacific Ry.

CENTRAL R. R. OF NEW JERSEY.—Dick & Co., of Hazleton, Pa., have commenced work with 75 men on a branch line from Audenried, Pa., to Pleasant Hill.

CHATAUGAY & NORTHERN.—It is stated that the contract for the first section of this road has been awarded to Messrs. Stewart, Howard, Lemay and Murphy. This section includes 12 miles of road from Montreal to Bout Le l'Isle. The engineers have just completed the location, and the contractors will now begin construction immediately. Secy., J. P. Mullarkey, Notre Dame St., Montreal.

DETROIT & MACKINAC.—Press reports state that surveyors are now engaged in running the line out for the extension of this railway through Arenac county, Mich., touching Au Gres, Omer and Standish, starting from Emery Junction and terminating at Bay City, for the present.

FRANKLIN & OIL CITY RAPID TRANSIT.—Incorporated in Pennsylvania Aug. 15 to build a steam railway between Franklin and Oil City; capital stock, $70,000; Pres., Wm. J. Welsh; directors, Jas. W. Rowland, and Charles W. Mackey, all of Franklin, Pa.

JACKSON & CINCINNATI.—Incorporated in Michigan to build a railway from Jackson to Addison, on the Cincinnati, Jackson & Mackinaw; Wm. D. Stearns, Toledo, O., of the latter company, has subscribed for 94 of the 100 shares; capital stock, $160,000.

JEFFERSON & ALLEGHENY.—This company, incorporated last year, proposes to build a railway from Punxsutawney to Allegheny City, Pa., 86 miles, the object being, it is said, to give the Buffalo, Rochester & Pittsburg an independent entrance into Pittsburg. The "Railway Age" states that Chas. F. Burnham, of Dubois, Pa., has been engaged for some time in securing the right of way, and it is said that the contracts may be let this year.

LANCASTER & HAMDEN.—J. G. Reeves, Pres., Lancaster, O., is quoted as stating that this road will be 60 miles long, running from Lancaster to Wellston, O., by way of the state reform farm, Clearport, Oakland, Tarlton, Adelphi, Laureville, Haynes, South Bloomingville, Plymouth Church, Allenville, Traphagaus and Hamden. The line is graded from Tarlton to Plymouth Church, 20 miles, and surveys have been completed from Plymouth Church to Wellston, 20 miles. About 2,000 tons of 65-lb. steel rails have been purchased and delivered at Tarlton with the necessary spikes, nails, etc. The grade is in first-class condition and the ties have been distributed along a good portion of the line. Tracklaying has been begun and work will be pushed with vigor. It is expected to have the 20 miles to Plymouth Church completed by about Oct. 1. Ch. Engr., Samuel Effinger, Tarleton, O.; Vice-Pres., W. B. MacCracken; Treas., P. Rising; Secy., B. F. Dunn, all of Lancaster, O. Gen. Supt., J. C. Harper, Circleville, O.

NORTHERN OHIO.—Incorporated in Ohio Aug. 14 as a reorganization of the Pittsburg, Akron & Western, noted last week; Pres., H. L. Brice (brother of Senator Brice); Vice-Pres., A. L. Conger; Secy., W. E. Hackedorn, of Indianapolis. It is stated that $1,000,000 will be spent in improving the road.

OHIO SOUTHERN.—Efforts are being made to raise $17,000 to secure an extension of this railway from Lima through Columbus Grove to Ottawa, O.

OTTAWA & GATINEAU.—Ballasting is now in progress on an extension of two miles north of Wright, Que., crossing the Pickanock River by a 160-ft. lattice girder bridge, which will be erected this autumn by the Dominion Bridge Co., of Montreal. It was hoped to build the line 10 miles further northward this season, but through some defect in the legislation concerning appropriations, the necessary subsidy was not available, but it is expected that this work will be done next season, carrying the line to the Blue Sea lake, in the center of a great fishing and sporting region. Ch. Engr. and Man. Dir., Wm. Dale Harris, Ottawa, Ont.

PITTSBURG, MONONGAHELA & WHEELING.—The stockholders of this company met at room 30, Germania Bank Bldg., Pittsburg, Pa., Aug. 12, and approved the location made by A. D. Neeld, Ch. Engr., for the 25 miles of road from the Pittsburg & Lake Erie road, opposite Monongahela City, to Clarkstown, in Washington county and it is expected that contracts will soon be awarded for this work. Pres., Wm. G. Dacey, 40 Wall St., New York.

TILSONBURG, LAKE ERIE & PACIFIC.—The contract for constructing 17¾ miles of this railway, as advertised in Engineering News in June, has been awarded to John M. Lally and J. V. Gearing, of Detroit, Mich. Ch. Engr., R. F. Tate, Tilsonburg, Ont.

Southern.

BIRMINGHAM, SHEFFIELD & TENNESSEE RIVER.—Press reports state that the Illinois Central contemplates purchasing this road at foreclosure sale, Sept. 16, and extending it from Jasper southeast to Birmingham, Ala., 40 miles, and from Florence, Ala., north to Jackson, Tenn., 60 miles.

BROOKSVILLE & WELLSBURG. — Residents of Brooksville, Ky., are reported to have subscribed $40,000 to build a railway from that city to Wellsburg, on the Chesapeake & Ohio, a distance of eight miles. Press reports state that the construction will be commenced at once.

LOUISVILLE & NASHVILLE.—Joseph Coyne, who is building the new extension of this road out of Shelbyville, Ky., is quoted as saying that he has about 500 men at work, and will employ 1,000 in a few weeks as soon as accommodations can be arranged.

MIDDLESBORO.—Incorporated in Tennessee Aug. 10, by F. M. Gordon, Henry Steele, W. E. Cable, S. Linknover and L. L. Robertson to build a railway from Bennett's Fork of Yellow Creek, in Claiborne county, on the line between Kentucky and Tennessee, through Claiborne and Campbell counties, to Careyville, in Campbell county, and to the coal mines on Cabin Creek, in the same county.

NASHVILLE CHATTANOOGA & ST. LOUIS.—W. S. Wells, of Huntsville, Ala., has been awarded the contract for constructing 1½ miles of track from the Nashville, Chattanooga & St. Louis Ry. to the West Huntsville cotton warehouse, gin, cotton mills and furniture factory.

QUEEN ANNE.—The contract for building the first section of this railway has been awarded by the Peninsular Construction Co. to William C. Merritt, of Easton, Pa. This portion of the line extends from Queenstown to Denton, about 20 miles. The contract includes the entire work necessary to prepare the road for rolling stock, and also embraces the building of a pier at Queenstown at which the steamboats giving connection with Baltimore will land. Work is to begin at once, and it is expected to have the section finished within six months. The grades along the route are light and the alinement is good, there being but few curves. Ch. Engr., I. W. Troxel, P. O. box 144, Baltimore, Md.

SOUTHERN RY.—This company will proceed at once to make many costly improvements on the North Carolina division of its property, which it has just re-leased for 99 years, including new passenger and freight depot buildings at Greensboro, Durham and Selma, N. C., also the replacing of several bridges between Greensboro and Raleigh with stronger iron structures, and the substitution of heavy steel rails for 85 miles of the track for the present light rails in use between Greensboro and Selma. These betterments are to be made as a part of the plan of the Southern to use this route in entering Norfolk, Va., its new deep-water terminus. The company is also improving its rolling stock.

TALLASSEE & MONTGOMERY.—Incorporated in Alabama Aug. 11 to build a railway, noted in our issue of Aug. 8; capital stock, $75,000; incorporators, John W. Burr, Jos. Goetter, Sigmund Roman and W. H. Micou, Jr., of Montgomery, and A. Millstead and W. H. Micou, Sr., of Tallassee, Ala. The contract for the grading, masonry and trestle-work on the line, 6¼ miles in length, has been awarded to Watkins & Hardaway, of Birmingham, Ala. W. G. Williamson, Ch. Engr., Montgomery, Ala.

WEST VIRGINIA SOUTHERN.—This company is said to be receiving bids for 56-lb. rails for five miles of its road, and for three 30-ton second-hand box cars and one or more locomotives. The contract for building the first five miles of the road was awarded to Gouch, Rinehart & Co., of Covington, Va., as noted in our issue of Aug. 1. Engrs., Venable & Vance, Charleston. Pres., R. R. Herndon, Charleston, W. Va.

Northwest.

CHICAGO & NORTHWESTERN.—Surveys have been made for a nextension of this railway northward from Oconto, Wis.

CHICAGO, PEORIA & ST. LOUIS.—This railway is to be sold at auction at Springfield, Ill., Sept. 14. The road will be sold in three parcels, the first including the line from Pekin to Havana and Jacksonville, the second being the line from Havana to Springfield, $250,000 of stock in the Peoria & Pekin railway, and the line from Springfield to East St. Louis, and the third is the line proposed to be built from Havana to Rock Island. No bid of less than $250,000 for the first parcel, $200,000 for the second, and $50,000 for the third will be accepted, and after each parcel is sold the property will be offered and sold as one piece if a greater price than the aggregate bid for the three parcels can be obtained. It is reported that among the probable bidders are the Cairo Short Line, the Santa Fe, and the Rock Island.

DES MOINES, NORTHERN & WESTERN.—It is stated that this railway will be extended from Fonda, Ia., its present northern terminus, to Spencer. The distance is less than 50 miles. This territory is at present without railway facilities, and the closing of this gap would provide a direct air line from Des Moines to Spirit Lake and the northwest via the C., M. & St. P. It is said the surveying will be done this fall and right of way secured, so tracklaying can begin early in the spring. Pres., F. M. Hubbell, Des Moines, Ia.

MARSHALLTOWN & DAKOTA.—Incorporated in Iowa to construct a road from Story City to a point in southeastern Dakota; capital stock, $2,000,000; incorporators, S. T. Meservey, Norman D. Fraser, and Hamilton Browne; principal office at Boone, Ia.; the company commenced business May 27.

WASHBURN, BAYFIELD & WESTERN.—The incorporation of this company was noted last week. Geo. L. Davis, of Grand Rapids, Mich., has been engaged as

chief engineer and superintendent of construction. Surveys for this road between Washburn and Bayfield, 60 miles, were made by Mr. Davis two years ago, and it is stated that the construction will soon be commenced. Bayfield county has voted a bonus of $240,000. Pres., R. D. Pike, Bayfield, Mich.

Southwest.

SAN JACINTO & NORTH TEXAS.—Incorporated in Texas to build a railway from a point on the Houston, East & West Texas road in Liberty county, 44 miles north of Houston, to run in a northwesterly direction about 40 miles to a junction with the International & Great Northern in Walker county; principal office at San Jacinto, Tex.; capital stock, $200,000; incorporators, William E. Davis, of Boston, Mass.; E. J. Minnock, Hayes Lougee, M. S. Cooper, W. P. McComb, of Montgomery county, Tex.; A. G. Hall, of Houston; L. W. Levy, of Galveston; E. L. Smith, G. I. Turnley and B. F. Ellis, of San Jacinto county, Tex.

TECUMSEH & SHAWNEE.—Incorporated in Oklahoma to build a railway from Tecumseh to Shawnee. The incorporators are said to be all residents of Oklahoma City.

TEXAS & PACIFIC.—The contract for building the Denison & Pacific Suburban, a branch of this road from Sherman to Denison, 10 miles, has been awarded to the St. Joseph Construction Co., of St. Joseph, Mo., and seven gangs of men are already at work on the line. McSweeny Bros. have been sublet the contract for the first three miles from Sherman.

Rocky Mt. and Pacific.

ARIZONA.—Fowler Bros., of Phoenix, Ariz., have recently secured a charter for a railway west of that town, and they propose to construct a road to extend 18 miles from Phoenix. It is stated that actual work of construction will begin during October.

BURLINGTON & MISSOURI RIVER.—R. O. Phillips, of Lincoln, Neb., right of way agent of this company, has been in Seattle, Wash., recently and the papers of that city assert that this road will soon be extended to Seattle.

CALIFORNIA, OREGON & IDAHO.—This company was incorporated in Oregon, April 17, 1895, to build a railway from San Francisco Bay to Casper, Wyo., the western terminus of the Chicago & Northwestern; capital stock, $800,000; incorporators, Robt. Clow, W. J. Morton, W. B. Beebe and C. A. Harp, of Junction City, Ore.; Cyrus W. Baldridge, of Kansas City, Mo., and J. M. Bassett, of Oakland, Cal. Press reports from Eureka, Cal., state that C. W. Baldridge has submitted a proposition for the construction of the road if Humboldt county will subscribe for $500,000 worth of bonds and that already more than half of that amount has been promised.

IRON MOUNTAIN.—It is stated that the grading was commenced on this road to Shasta county, Cal., on Aug. 1, and the line will be immediately completed to the Sacramento River. The distance between that point and Iron Mountain is 11 miles. The rails have all been purchased and will be delivered as soon as needed. The road has heavy grades, 198 ft. to the mile, and a maximum curvature of 36°. Ch. Engr., M. M. O'Shaughnessy, Crocker Bldg., San Francisco.

STREET AND ELECTRIC RAILWAYS.

PORTLAND, ME.—Portland & Yarmouth Electric Ry. Co. has asked for a location of its railway within the city of Portland. Edwin L. Dyer, Cy. Clk.

HANOVER, MASS.—The Rockland & Hanover Electric R. R. Co. is considering the question of beginning work at once on its proposed road, as the full amount of the capital stock, $20,000, is reported as subscribed. Pres., C. H. Killam; Treas., F. H. Curtis; Clk., H. L. Curtis.

SPRINGFIELD, MASS.—Bids are asked for furnishing trolley, feeder and overhead material for four miles of electric railway. Fred T. Ley & Co., Springfield, Mass.

ALBANY, N. Y.—The Albany, Helderberg & Schoharie Electric Ry. Co. has been organized with a capital stock of $350,000; Pres., John W. Vanvalkenburgh; Vice-Pres., Jonas H. Brooks; Treas., Theodore Little; Secy., W. H. Erwin; Gen. Man., C. Kromer.

BINGHAMTON, N. Y.—E. A. Matthews has been awarded the contract for grading the proposed Binghamton & Union electric railway.

GREENWICH, N. Y.—The Greenwich & Schuylerville Electric Co. is about to be incorporated to build a road between this place and Schuylerville; capital stock, $200,000. Pres., Martin Schenck, of Troy; Treas., T. W. Cantwell, of Albany; directors, James Mealey and James E. Kelly, of Schuylerville, and Robert Hamilton and R. N. Sprague, of Greenwich.

JAMAICA, N. Y.—The Kings, Queens & Suffolk R. R. Co. has been incorporated to construct a narrow-gage railway about nine miles in length, with termini at the westerly line of Jamaica, and in the village of Far Rockaway. Capital stock, $350,000; directors, Carl Frederick Wilhelm Bodecker, of New York; Frederick Fitter, of Brooklyn; John N. Williamson, of Ozone Park; George Pitkin Bergen, of Freeport, and 26 others.

SAYVILLE, N. Y.—I. G. Terry and W. N. Raynor have been appointed a committee to make arrangements for securing right of way and estimates for the proposed cycloid railway into this place. H. T. Rogers.

CAMDEN, N. J.—The Camden, Gloucester & Woodbury Ry. Co. has petitioned the council for a franchise for extending its electric railway in the city. T. P. Barney, Cy. Clk.; Supt. H. M. Royal.

NEW BRUNSWICK, N. J.—Press reports state as follows: A plan embracing the substitution of electricity for steam is being considered by the Pennsylvania R. R. Co. on the Millstone branch of its line. As planned, the road will begin at East Millstone, continue through Middlebush and Voorhees Station, as at present, and connect with the tracks of the New Brunswick City Ry. Cars can then be continued through the city to the tracks of the Brunswick Traction Co., and thus give a continuous line between East Millstone and South Amboy.

HARRISBURG, PA.—It is reported that a company has been organized in this city for the purpose of furnishing motive power for street railways by a method invented by Supt. Beitzel, of Boiling Springs, which does away with cables, trolleys and poles. Pres., J. Hoetzenger; Vice-Pres., R. E. Daubba, of Mifflin; Treas., Robert Means, Mifflin; Secy., Theodore Cornman, of Carlisle. The experimental road will be built at Washington, D. C. A meeting will be held soon, and it is probable the company will then be chartered.

OIL CITY, PA.—The Oil City Rapid Traction Ry. Co. has been incorporated to build a railway between this city and Franklin; capital stock, $70,000; directors, James W. Roland, Charles W. Mackey, William H. Forbes, Edward E. Hughes, William J. Welsh and John S. May.

PHILADELPHIA, PA.—The Union Traction Co. has petitioned for a charter to construct and operate cable and electric railways in Philadelphia. James M. Manes, Peter A. B. Widener, William L. Elkins, Jeremiah J. Sullivan, Alex M. Fox and others are interested.

POTTSVILLE, PA.—Bids are asked until Aug. 27 for building six miles of electric railway from Schuylkill Haven to this city, and six miles from Minersville to Hecksherville and Taylorville for the Schuylkill Electric Ry. Co. W. W. Hess, Pres. Philadelphia Construction Co.

SCRANTON, PA.—The Dunmore Electric St. Ry. Co. has been incorporated to build a road to Dunmore and Carbondale; capital stock, $75,000; Pres., P. J. Horan, of Dunmore; directors, L. H. Burns, E. J. Linnett, T. E. Boland and M. J. Sweeney.

BALTIMORE, MD.—H. T. Douglas, Pres. Baltimore-Cantonsville Construction Co., writes us that E. D. Smith & Son, of Philadelphia, have been awarded the contract for the grading, masonry, track superstructure and tracklaying for the proposed electric railway between Washington and Baltimore, with a branch to Ellicott City, Md., as noted in our issue of last week. The work will begin immediately, and is to be completed by March, 1896. The contracts for the electrical equipment, including the poles, arms, overhead wires, power houses, car barns and cars, have not been awarded, but they will be taken up at an early date.

FOREST GLEN, MD.—The Washington, Woodside & Forest Glen Ry. & Power Co. has been incorporated to build an electric road to Washington by way of Woodside and Silver Spring. Pres., Frank J. Browning; Vice-Pres., Julian C. Dowell; Treas., W. Riley Dechle; Secy., Frederick Benjamin.

LAYHILL, MD.—The question of constructing an electric road from this place to connect with either Kensington or the extension of the Seventh St. road, which is to form a link of the proposed electric line from Washington to Gettysburg, Pa. Chas. H. Parker, H. W. Cashell, Headly Beall, O. H. Van Horn and M. L. Littlefield are interested.

RICHMOND, VA.—It is reported that the Richmond Traction Co., composed of Everett Weddey, Reuben Sheriffs, Philip B. Shield, Charles T. Child and others will build an electric trolley line on Broad St.

KNOXVILLE, TENN.—The Citizens' Ry. Co. has been incorporated to build an electric line in Knoxville, West Knoxville, North Knoxville and Knox county. It may possibly be consolidated with the West End electric line and the Fountain City dummy. The incorporators are W. G. McAdoo, Jr., F. K. Huger, George W. Henderson, R. H. Sanson, E. T. Sanford and T. H. Heald.

CANTON, O.—It is reported that a company has been incorporated to build an electric railway from Canton to Akron and Cleveland, by way of the Akron, Bedford & Cleveland Ry. A. A. Hoover, of New Berlin; Lewis Smith, of Greentown; Milo White, of Springfield, and W. A. Lynch, of Canton, are interested.

CINCINNATI, O.—The Cincinnati St. Ry. Co. has been petitioned to extend its electric line to Mount Airy, a distance of about 12½ miles. W. J. M. Gordon, Chn. Com.; Dr. A. Ravogli, Secy. Mount Airy, Groesbeck, Bevis & Venice Improvement Association. J. H. Smith, Wiggins Block, is the attorney for the association.

CLEVELAND, O.—Bids are asked until Sept. 15 for the construction and operation of an interurban electric railway between South Brooklyn, a suburb of Cleveland, and Akron, O., according to reports. Address H. W. Baird, 901 Garfield Bldg.

URBANA, O.—W. H. Hanford & Co., of Springfield, have petitioned the council for a franchise for an electric road.

INDIANAPOLIS, IND.—M. Frost and Charles Larne, contractors of Tiffin, O., are reported as making arrangements with Grafton Johnson, of Indianapolis, for constructing the proposed electric railway between this city and Greenwood.

RICHMOND, IND.—The electric street railway system of this place will be sold at sheriff's sale, Sept. 14 to satisfy a mortgage held by the Union Trust Co., of St. Louis, Mo.——The proposed electric railway from Richmond to Connersville is being pushed by citizens of this place. The road as proposed will be about 65 miles long. Address, James S. Ostrander.

DETROIT, MICH.—The Detroit Citizens' St. Ry. Co. has been granted permission to extend its electric road in Brush St.

PONTIAC, MICH.—The Pontiac & Sylvan Ry. Co. has been incorporated with a capital stock of $50,000, by M. D. Mills, Thaddeus A. Smith, William J. Hinman.

PEORIA, ILL.—The Central Ry. Co. has been granted permission to extend its electric road. Ch. Engr., A. L. Kellogg; Electrician, D. T. Flynn.——The Fort Clark St. Ry. Co. has been granted a franchise for its electric road. Receiver, F. W. Horne; Supt., W. D. Allison.

ROCKFORD, ILL.—The West End St. Ry. Co. is considering the question of building several extensions. Gen. Man., J. S. Ticknor; Supt., C. H. Murtagh; John Farson, of Chicago, is interested.

NEENAH, WIS.—It is reported that work will commence on the Wisconsin Interurban Ry. Co's. projected electric road between this place and Kaukauna. The company has been granted franchises for its railway in Menasha and Appleton. F. C. Rutan, of Chicago, is interested.

OSHKOSH, WIS.—It is stated that $450,000 has been issued by the Central Wisconsin Electric Ry. Co. for continuing the construction of its road in this city. J. K. Tillotson and E. E. Stevens.

DULUTH, MINN.—It is reported that the owners of the Minnesota Point St. Ry. are considering the question of equipping the road with electricity next spring Pres., J. J. Hibbard.

LITTLE ROCK, ARK.—The Healey St. Ry. Co has been granted a franchise to extend its electric road.

NEVADA, MO.—Col. George Dudley, of St. Louis, has been granted a franchise for an electric railway and electric light plant. Work will be begun at once. The bids considered were as follows: George Myers, of Kansas City, representing the Missouri, Kansas & Texas Trust Co., 2½% of the gross earnings; J. Bailey, of Argentine, Kan., 2⅝%, and Col. Geo. Dudley, 2⅝%. The city is to pay $75 each a year for 50 arc lights.

DENVER, COL.—The Denver, Globeville & Golden Rapid Transit Co. has been incorporated with a capital stock of $100,000 by Lewis E. Lemen, George S. Parsons, Irving F. Root, Robert C. Lingo and S. Roy Wright.

PORTLAND, ORE.—Bids were received by Dayton & Hill, First and Taylor Sts., Aug. 19, for building a double track electric railway in First St.

OROVILLE, CAL.—The construction of an electric railway from Oroville and Butte City to Palermo and Biggs by way of Rio Bonito, is being considered. Hatch & Rock, Alexander & Hamilton, W. Treat & Son and Reed & Johnson are some of the firms interested in the discussion.

SANTIAGO, CAL.—It is reported that George B. Kerper, owner of the Santiago Cable Ry., will change the system to electricity, and will extend the line to National City, at an estimated cost of $500,000.

NIAGARA FALLS, ONT.—Application has been made to the Ontario government for a charter for the International Belt Line Ry. Co.; capital stock, $500,000. Besides operating a railway, permission will be asked to supply light, heat and power. Incorporators, Capt. Brinker, of Buffalo, N. Y.; W. Kyle, of Toronto, Ont., and Dr. Ames and M. Donnelly, of Niagara Falls, Ont.

ELECTRIC LIGHT AND POWER.

SENECA FALLS, N. Y.—Bids are asked until Sept. 2 for lighting the streets of this place. Horace D. Knight, Village Clk.

UTICA, N. Y.—The Utica Highlands Co., 31 to 36 Arcade, is considering the question of developing the water power at the Prospect dam, on the West Canada Creek, above Prospect, N. Y. Engrs., A. L. Edic, Genesee St., Utica. A. D. Hughes; Pres., Edward D. Matthews.

HONEA PATH, S. C.—Press reports state as follows: W. C. Whitner, Engr., of Anderson, S. C., has just finished a survey of Ware's shoals, 10 miles below this place, at the instance of the owners. He finds that there is a fall of 50 ft. in one-eighth of a mile. The owners of the shoals are forming a company for the purpose of building an electric plant at the shoals and transmitting the power to Laurens, 20 miles away, to run the cotton mills which are being built there.

BARDSTOWN, KY.—The General Electric Co., of Cincinnati, O., has been awarded the contract for erecting an electric light plant at $7,194.

SAULT STE. MARIE, MICH.—Press reports state as follows: The water power at this place was purchased Aug. 14 by the Philadelphia syndicate of capitalists which is developing the Canadian water power, for $68,000. The work of development here will be begun as soon as plans are drawn and preliminary work done. The right of way purchased is three miles long and 400 ft. wide the greater part of the distance. About 50,000 HP. will be developed as soon as practicable. Big pulp mills will be erected and other enterprises established. The purchase includes valuable water frontage and 100 acres suitable for mill sites. The syndicate has a Canadian grant of 640,000 square acres of pulp wood lands. F. H. Clergue has been representing the syndicate.

ROCKFORD, ILL.—The council has directed that plans be prepared for a municipal electric light plant. An option has been secured on the Chick milling property, on the river, with excellent water power, which can be purchased and amply equipped for about $55,000. With this plant 350 arc lights of 2,000 c. p. each can be run at a cost of from $10,000 to $12,000 per year. This will give the city four times as much light as at present at a saving of from $5,000 to $7,000 annually.

APPLETON, WIS.—The council is considering the question of asking for bids for lighting the streets with electricity.

MILACA, MINN.—The town has voted to issue bonds for electric lights and water works, according to reports.

KERRVILLE, TEX.—The construction of an electric light plant is being considered.

FLAGSTAFF, CAL.—The Flagstaff Electric Light Co. has been granted a franchise. Pres., D. M. Riordan; Man., Thomas Jasper; Treas., F. W. Sisson.

ALEXANDRIA, ONT.—The citizens have voted to appropriate $23,000 for an electric light plant and a water-works system.

INGERSOLL, ONT.—Bids are asked for lighting the town with electricity or gas for five years. Thos. H. Noxon, Chn. Com.

WINDSOR, ONT.—The council has voted to spend $5,000 on improvements for the electric light plant on Pellissier St.

NEW COMPANIES.—The Kane Electric Co., Kane, Pa.; $1,000; Treas., Thos. J. Kane, Kane.

City Electric Light Co., Danville, Ill.; $15,000; Frank Lindley, Daniel Gregg, Robert Holmes.

New Electric Construction Co., New Britain, Conn.; $5,000; Pres., I. W. Fish; Secy., H. P. Horne.

Central Light & Power Co., Montreal, Que.; $50,000; Richard White, Edward H. Barker, Frank B. Kane.

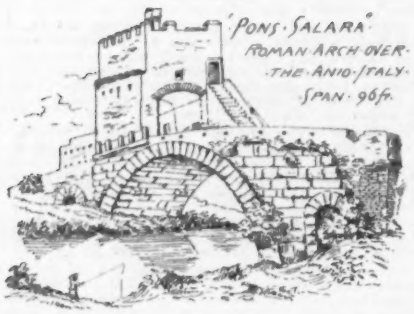
Valparaiso Light & Power Co., Valparaiso, Ind.; $50,000; Chas. A. Sweet, Charles Burgeson, E. F. Vannes.

Mountain Electric Light Co., Summit, N. J.; $100,000; Carrol Ph. Bassett, Adolph Wagner, Frederick Green, of Summit.

Hasbrouck Heights Light, Heat & Power Co., Hasbrouck Heights, N. J.; $50,000; Edward M. Anson, Jules F. Viallos, David B. Mitchell, John S. Hanson.

Brothers Electric Cable Crane Co., Newark, N. J.; $6,000, with full amount paid in; to manufacture electric cables, cranes, etc.; Wm. F. Brothers, Brooklyn, N. Y.; Isaac P. Brown, Jr., Plainfield, N. J.

BRIDGES.



BELFAST, ME.—The citizens voted Aug. 14 to construct a bridge 1,300 ft. long over Belfast Harbor, at an estimated cost of $85,000. The plans for the proposed bridge were prepared by E. J. Morison, as noted in our issue of Aug. 15.

TAUNTON, MASS.—The council has considered favorably the petition of H. S. Culver and others for an iron bridge at Westville, to cost $6,000.

BROOKLYN, N. Y.—The awarding of a contract for a lift bridge over Newtown Creek, at a cost of $418,000, was noted, and the bids published, in our issue of Aug. 8. This award has been vetoed, and the work will probably be readvertised.

FLUSHING, N. Y.—Press reports state as follows: The Long Island R. R. Co. has been directed by the war department to rebuild the drawbridge across Flushing Creek. The present bridge crosses the creek diagonally, and has always interfered with the passage of vessels, and has now been condemned. A new one has been ordered with a 40-ft. draw placed squarely across the stream.

STAPLETON, N. Y.—Bids are asked until Sept 3 for constructing a steel highway bridge and a wooden trestle over Fresh Kills Creek and Salt Meadow, as stated in our advertising columns. Engr., Henry P. Morrison; Franklin C. Vitt, Clk. Bd. Supervisors.

SYRACUSE, N. Y.—Bids are asked until Aug. 26 for constructing a stone arch bridge over Harbor Brook at Park Ave. Henry C. Allen, Cy. Engr.; H. F. Stephens, Cy. Clk.

CAMDEN, N. J.—Bids are asked until Aug. 26 for constructing an iron bridge over Pensaukin Creek at West Palmyra, and an iron bridge 30 ft. long and 18 ft. wide, over a stream at Colestown. Samuel Jaquillard, Chn. Bd. Camden County.

NEW BRUNSWICK, N. J.—The Pennsylvania R. R. Co. has awarded the contract for a new double track bridge over the river at this place. It will be similar to the present structure and will rest upon the piers built last year.

ALLEGHENY, PA.—W. A. Magee has been authorized to build a highway bridge over the Allegheny River at 10th St.

McKEESPORT, PA.—The Second Ave. Traction Co. has decided to construct an iron viaduct over the tracks of the Pittsburg, Virginia & Charleston R. R. in Dravosburg, at an estimated cost of about $15,000.

OIL CITY, PA.—It is stated that the Allegheny Valley R. R. Co. intends building a new steel bridge at Oil City in place of the old one which crosses the river at this city. The estimated cost of the structure is about $50,000.

UNIONTOWN, PA.—The commissioners of Fayette and Westmoreland counties have decided to build an iron bridge, 80 ft. long and with a roadway 16 ft. wide, over Jacobs Creek at Everson. The county engineer will make surveys and plans at once.

WILKES BARRE, PA.—It is stated that the Heights railway company is about to build a bridge over the Central & Lehigh Valley R. R. tracks to connect with the Canal St. line near the Dickson foundry.

RICHMOND, VA.—The question of submitting the proposition for constructing a viaduct on Church Hill to the vote of the citizens at the election in November is being considered. T. Wylie Davis, of Church Hill, and J. Taylor Ellyson and E. A. Catlin are interested.

WEBSTER, W. VA.—Bids are asked for constructing a steel or iron highway bridge, 125 to 100 ft. long. R. D. Smith, Clk. County Court.

WHEELING, W. VA.—It is reported that surveys have been made for a highway bridge over the Ohio River to connect Benwood and Bellaire.

FOREST CITY, N. C.—The county commissioners are to build a 225-ft. iron bridge over the river Henrietta at the new mill, at an estimated cost of $3,000. The piers and masonry work will be done by Mr. Tanner. J. F. Flack, J. B. Blanton, Comrs.

NEW ORLEANS, LA.—The finance committee of the city council opened the following bids Aug. 12 for the construction of an iron bridge across the Bayou St. John at Dumaine St.:

Toledo Bridge Co.	$18,450
Bowles & Dearborn	18,990
A. J. Christopher	20,710
Gillette-Herzog Mfg. Co.	18,625

Our correspondent writes that the city council, a few weeks ago, adopted an ordinance requiring all bidders for city work to pay a license before being eligible to bid. A majority of the bridge companies desiring to bid for this work was unable to do so, being in the dark as to the license matter, and only being told of it when they reached New Orleans, and they were therefore not in position to bid. In future, it would be well for bridge builders to bear in mind that before they can bid for work in New Orleans they must first pay a city license fee of $120 a year.

CINCINNATI, O.—The engineer of the board of administration has prepared estimates for an iron bridge 285 ft. long over Montgomery Road from Gilbert Ave. to Kenton St., estimated to cost $44,863. It is probable that the work will be begun this fall.——The following bids have been received for building a bridge over Mill Creek, on Spring Grove Ave., near Ivorydale; F. S. Krug, County Engr.:

Brackett Bridge Co., plan A, Cincinnati, O.	$35,950
" " " " B, " "	29,588
" " " " C, " "	26,000
" " " " D, " "	22,350
King Bridge Co., asphalt floor, Cleveland, O.	37,010
" " " brick floor, " "	37,000
Keepers, Wynkoff & Thatcher, Detroit, Mich.	37,000
Youngstown Bridge Co., Youngstown, O.	40,000
Massillon Bridge Co., Massillon, O.	37,200
Variety Iron Works, asphalt floor, Cleveland, O.	39,000
" " " brick floor, " "	38,000
Wrought Iron Bridge Co., brick floor, Canton, O.	42,000
" " " asphalt floor, " "	41,000
Wisconsin Bridge Co., asphalt floor, Milwaukee.	38,200
" " " brick floor, " "	40,000

JEFFERSON, O.—The following bids were received Aug. 8 for constructing a steel cantilever bridge over Ashtabula Creek:

Toledo Bridge Co., Toledo, O.	$75,900
Variety Iron Works Co., Cleveland, O.	75,000
Youngstown Bridge Co., Youngstown, O.	76,320
New Columbus Bridge Co., Cleveland, O.	75,490
King Bridge Co., Cleveland, O.	$54,200 to 75,300
Penn Bridge Co., Beaver Falls, Pa.	75,800
Champion Bridge Co., Wilmington, O.	80,000
Detroit Bridge & Iron Works, Detroit, Mich.	77,000

Plan A of the King Bridge Co. will probably be adopted at $74,999.

MIDDLETOWN, O.—The county commissioners have voted to erect a swing bridge over the canal as soon as the city secures the right from the state board of public works.

ZANESVILLE, O.—Bids are asked until Sept. 2 for constructing a steel draw span at the west end of the county bridge at Taylorsville. The span is to be 148 ft. long, with a roadway 16 ft. in width, and a sidewalk 6 ft. wide. G. E. Zimmer, Audr. Muskingum County.

MADISON, IND.—Bids are asked until Sept. 3 for constructing a steel or iron bridge with a stone substructure. G. S. Taylor, Audr.

ELGIN, ILL.—It is reported that a new bridge will probably be constructed over Fox River at Chicago St.

ROCK ISLAND, ILL.—The contract for the new bridge over the Mississippi River at this place has been awarded to the Phoenix Bridge Co. This bridge consists of the following spans: One draw span of 365 ft. 7 ins. c. to c. end pins, two fixed spans of 258 ft. c. to c. end pins, three fixed spans 216 ft. 6¾ ins. c. to c. end pins, one fixed span 193 ft. 3 ins. c. to c. end pins, one fixed span 98 ft. 9 ins. c. to c. end pins. The bridge is designed to carry a double track railway on the upper deck, with a double roadway and two sidewalks below. The total weight of the metal will be about 11,000,000 lbs., and the cost will be about $500,000. This new structure replaces the original bridge built by the Phoenixville Bridge Works in 1871. The new structure is to be completed within the next nine months.

CHIPPEWA FALLS, WIS.—Bids are asked until Aug. 26 for constructing three tubular steel piers for a highway bridge over Chippewa River; steel ¼-in. thick, tubes 7 ft. diameter and 33 ft. high. F. M. Buzzell, W. W. Jenkins, O. J. Nyhus, Bd. Pub. Wks.

MILWAUKEE, WIS.—The Continental Bridge & Improvement Co. has been incorporated with a capital stock of $1,000 by Max Hildebrandt, Chas. J. Bertschy and S. E. Abrams.——The council is considering the question of constructing a new bridge at Huron St.

MARENGO, IA.—Bids are asked until Sept. 4 for constructing an iron or steel bridge of two spans of 60 and 70 ft. J. F. Lutton, Audr.

TOLEDO, IA.—Bids are asked until Sept. 4 for erecting a one-span iron bridge, 125 ft. long, over Otter Creek near Chelsea, a station on the Chicago & North Western Ry. Howard Everett, County Audr.

BEATRICE, NEB.—Bids are asked until Aug. 26 for constructing five iron bridges, each from 32 to 40 ft. long and to have a roadway 16 ft. wide. Samuel Bivens, Chn. Com.; T. E. Wilson, County Clk.

AITKIN, MINN.—Mason, Lewis & Co., of Chicago, have purchased $16,000 of county bonds voted toward building a bridge over the Mississippi River.

BROOKINGS, S. DAK.—Bids are asked until Sept. 2 for building a wooden bridge over Six Mile Creek in Afton township, and for a wooden bridge over Sioux River. J. T. Nelson, County Audr.

PORT ANGELES, WASH.—A. J. Adams, Cy. Engr., has prepared plans for a new bridge 124 ft. long over the Upper Elwha River.

SEATTLE, WASH.—Bids are asked until Sept. 2 for constructing a one-span highway bridge, 112 ft. long, over the north fork of the Snoqualmie River near North Bend. Nathan Bemen, County Audr.

BUILDINGS.

BOSTON, MASS.—Bids are asked by the state house construction commissioners until Aug. 31 for the plumbing work for the state house extension. Arch., Charles Brigham, 27 Mount Vernon St.——Andrews, Jacques & Rantoul have prepared plans for John Codman for a 11-story brick hotel, 104 × 26 ft. and 125 ft. in height, at 177 Tremont St., to cost $100,000.

SPRINGFIELD, MASS.—D. B. Wesson, Elisha Morgan, C. H. Parsons, and A. N. Mayo have been appointed a committee to secure plans and estimates for a city market building at Bridge, Dwight and Hillman Sts.

PROVIDENCE, R. I.—It is probable that the plans submitted by Martin & Hall for the new East Side high school building at Alumni Ave. and Hope St. will be accepted by the committee on city property. The building will have a seating capacity of about 1,400.

PROVIDENCE, R. I.—Bids are asked until Sept. 4 for the erection of superstructures, excepting iron roofs, for an engine house 48 × 90 ft., and 33 ft. high; a filth hoist building 24 × 27 ft., and 19 ft. high, a boiler and coal house 70 × 72 ft. and about 19 ft. high, and a chimney 16 × 16 ft. at base and 150 ft. high, buildings to be of brick, with stone trimmings, for a sewage pumping station, and also for constructing a steel roof for the station. Robt. E. Smith, Comr. Pub. Wks.

HARTFORD, CONN.—It is reported that the county commissioners will soon ask for bids for an addition to the county jail.

BINGHAMTON, N. Y.—Plans are asked until Aug. 24 for the proposed Barlow school of industrial arts. Address Wm. E. Shapley, Chn. Com. Bd. Education.

BROOKLYN, N. Y.—P. Lauritzen & Co., of New York, have prepared plans for the proposed alterations and improvements to the county hospital buildings in Flatbush, estimated to cost $200,000 to $250,000, as noted in our issue of Aug. 1.

BROOKLYN, N. Y.—The park commissioner received the following bids Aug. 20 for building the first wing of the proposed museum of the Brooklyn Institute of Arts and Sciences in Eastern Parkway: Thomas B. Rutan $237,926; John Thatcher, $256,500; John J. Cashman, $259,820; M. Gibbons & Sons, $255,767; W. & T. Lamb, $270,493; P. & J. Carlin & Co., $254,763, and the Probst Construction Co., $252,320.

BUFFALO, N. Y.—Bids are asked until Aug. 30 for furnishing and erecting the structural and ornamental iron and steel work required for the Masten Park high school building. R. G. Parsons, Secy. Dept. Pub. Wks.——The building committee has been directed to advertise for bids for constructing a building at the Zoo, to be 100 × 45 ft. and one story high. Arch., H. L. Campbell.

DOBBS FERRY, N. Y.—Press reports state that a New York syndicate, including Cornelius Vanderbilt, J. Pierpont Morgan, Gen. Samuel Thomas, Wm. and John D. Rockafeller, Chauncey M. Depew, J. G. McComb and D. Archibald, has purchased about 230 acres of land at this place and intends to establish a country club. A large hotel and casino similar to that at Newport will be erected, and these and other buildings which will be put up on the property will cost about $1,000,000. The club is now constructing a private pier to cost about $40,000.

NEW YORK, N. Y.—The board of education proposes to construct seven school buildings to be located as follows: First Ave. and 91st St.; St. Nicholas Ave., between 126th and 127th Sts.; south side of 20th St., between First and Second Aves.; Rivington St., between Forsyth and Eldridge Sts.; block bounded by Varick, North Moore and Beach Sts.; block bounded by East Broadway, Scammell, Henry and Gouverneur Sts.; East 149th St., from Beach to Mt. Vernon Aves. It has been unanimously resolved to petition the Supreme Court through the Corporation Counsel for the appointment of commissioners to condemn for school sites the property described.——B. & J. Walther, 205 East 125th St., have prepared plans for a six-story brick cold storage building, 76 × 70 ft., to cost $40,000, on 119th St., near Third Ave., for Richard Webber, 1871 Madison Ave.——Work has been begun on a brick building to be used as a skating rink on 66th St., near Central Park, for the St. Nicholas' Skating Club, which has a capital stock of $250,000. The building will be 225 × 100 ft. and 75 ft. high. The floor will have an area of 16,000 sq. ft. Archs., Ernest Flagg and Walter B. Chambers. Cornelius Vanderbilt, August Belmont, J. J. Astor and Joseph H. Choate are interested.

ROCHESTER, N. Y.—Bids are asked by the superintendent until Aug. 26 for the plumbing and sewerage for the chapel to be erected for the state industrial school. Archs., Nolan, Nolan & Stern.

HOBOKEN, N. J.—Bids are asked until Sept. 5 for erecting a brick chimney for the New Public Road electric light station at Snake Hill; bond, $2,000. John Boyd, Clk. Bd. Freeholders.

NEW KENSINGTON, PA.—Bids are asked until Aug. 26 for erecting a new school building. E. H. Romig, Secy. Bd. Education.

BALTIMORE, MD.—Bids are asked until Sept. 4 for erecting a school building at Hanover and Lee Sts.; check, $1,000. J. Theo. Oster, Inspector of Bldgs.

BALTIMORE, MD.—Bids are asked until Aug. 28 for painting and repairing three buildings. J. T. Oster, Inspector of Bldgs.——The court house commission has been petitioned to put an elevator in the old U. S. court house.

HAMPTON, VA.—Bids are asked until Aug. 26 for the plumbing and steam heating apparatus and electric wiring for two barracks for the southern branch of the national home. William Thompson, Treas.

HOT SPRINGS, VA.—It is reported that Mr. Sterry, Man. Homestead Hotel, is considering plans for a new hotel, to be built on the site of the Homestead, work on which will begin in September.

CENTER, ALA.—Plans are asked for a three-story brick court house. R. R. Savage, County Judge.

NEW ORLEANS, LA.—Bids are asked for 600 fireproof doors, as stated in our advertising columns. A. W. Swanitz, Ch. Engr. Delta Construction Co.

COLUMBUS, O.—Fred W. Elliott, of Zanesville, has prepared plans for a seven-story building at High and Nephew Sts. for F. E. Powell, of Columbus, to cost $120,000.

INDEPENDENCE, O.—Bids are asked until Sept. 11 for erecting a two-story brick high school building at Independence Center. Arch., Wm. W. Sabin, Blackstone Block, Cleveland; A. H. Bowlzer, Clk., Independence.

INDIANAPOLIS, IND.—The Louisville, New Albany & Chicago Ry. Co. has purchased land in South East St. on which it is proposed to erect a large freight station.

DETROIT, MICH.—Bids are asked until Aug. 26 for constructing three brick fire engine houses. Archs., Mason & Rice, Bank Chambers; James E. Tryon, Secy. Fire Com.

CHICAGO, ILL.—Bids are asked until Sept. 20 for steel supports, floor plates, steps, tracks, etc., for the public library building in Dearborn Park. W. B. Wickersham, Secy.

CHICAGO, ILL.—Bids are asked until Sept. 20 for the interior finish of the public library building in Dearborn Park. The work will include iron, steel, cement, masonry, etc. Secy. W. B. Wickersham, care Shepley, Rutan & Coolidge, Venetian Bldg., Chicago.

CHICAGO, ILL.—Building permits have been granted to the Great Northern Hotel Co. for an addition and theatre, to cost $1,000,000, to its present structure.—Plans have been prepared by Jenney & Mundie for a 12 or 15-story office building, 67 × 50 ft., at 352 to 356 Dearborn St., near Fourth Ave., to cost $200,000, for Thos. A. Davis.

HAVANA, ILL.—Bids are asked until Aug. 28 for constructing a city hall. Bernard Wolters, Cy. Clk.

JOLIET, ILL.—It is proposed to erect a public library building, at an estimated cost of $36,000.——Press reports state that plans have been prepared at the penitentiary for a new female prison, for which the state has appropriated $75,000, and that work will be commenced soon. The entire structure will be of Joliet

stone, quarried by convict labor in the prison quarry in this city. The building will be 300 x 300 ft. and three stories high.

QUINCY, ILL.—Bids are asked until Aug. 26 for erecting a new hospital building at the soldiers' home. Arch., James Batschy, Quincy; Wm. H. Kirkwood, Supt. Soldiers' and Sailors' Home.——Plans have been prepared for an armory building with a drill hall, 100 x 50 ft. for Company F, on Main St., near Eighth St.

DES MOINES, IA.—Bids are asked until Sept. 9 for a steam-heating plant and for plumbing a high school building, in North Des Moines. Arch., Clinton Nourse, Des Moines; George Royal, Secy. Bd. Education.

PLATTSBURG, MO.—I. P. Schmidt, 411 New Ridge Bldg., Kansas City, Mo., is preparing plans for a two-story brick court house.

FORT WORTH, TEX.—Bids are asked until Sept. 12 for plumbing, etc., for the post office building. Wm. M. Aiken, Supervising Arch., Washington, D. C.

SAN ANTONIO, TEX.—Bids are asked until Sept. 9 for constructing a hospital building at Fort Sam Houston, Tex. G. C. Smith, Q. M. Gen., U. S. A., San Antonio.

SAN FRANCISCO, CAL.—It is reported that Claus Spreckles has awarded the contract for a 15-story office building at Market and Third Sts., to cost about $1,000,000.——The "Call" is reported about to erect a 15-story building, at a cost of $500,000.

SANTA FE, N. MEX.—J. H. Rapp, of Chicago, Ill., has been directed to prepare plans for rebuilding the state capitol.

ST. JOHN, N. B.—Bids are asked until Aug. 27 for heating the Erin St. school building. Arch., R. C. J. Dunn; Edward Manning, Secy. School Board.

WATER-WORKS.

BUCKSPORT, ME.—The present water supply is said to be unsatisfactory both in quality and quantity, and there is talk of organizing a new company.

MACHIAS, ME.—The Machias Water Co. has directed the selectmen to locate hydrants for the proposed works, which it is thought will be constructed at once.

SOMERSWORTH, N. H.—It was expected that plans and estimates would be completed last week for the new works.

BRIDGEWATER, MASS.—The contracts for seven additional artesian wells have been awarded to D. L. Baker, of Providence, R. I. The wells will be 202 ft. deep, and are to supply 250 gallons per minute.

BROCTON, MASS.—P. W. Mason, Brewer Phillips, and Elisha Fay have been appointed to appraise the land taken by the corporation for the purpose of constructing works.

LEXINGTON, MASS.—At a special town meeting, Aug. 17, it was voted to ratify the action of the selectmen in purchasing the works for $200,000, and also to make extensions in several streets.

LOWELL, MASS.—Bids are asked until Aug. 29 for furnishing 700 tons of 24-in. pipe, as stated in our advertising columns. Miles F. Brennan, Pres. Bd.

SHIRLEY, MASS.—G. M. Ballou, Homer Wilson, H. O. Peasley and others, have been appointed a committee to secure information in regard to proposed works at this place.

ATTICA, N. Y.—It is stated that F. C. Stevens, who has a franchise for works at this place, will construct a plant, including a reservoir and providing a pressure of 120 lbs. per sq. in. for fire purposes.

BUFFALO, N. Y.—Bids are asked until Aug. 30 for a 30,000,000-gallon vertical triple expansion pumping engine and also for rebuilding three Worthington pumping engines. R. G. Parsons, Secy. Dept. Pub. Wks.——Col. Geo. A. Davis, Chn. Bd. of Supervisors, is reported about to call a special meeting of the board to consider the proposed construction of a 1,000,000-gallon reservoir att the almshouse.

CASTORLAND, N.Y.—The residents of this place, in Lewis county, are considering the feasibility of establishing water-works.

CHARLOTTE, N. Y.—J. Flynn, George Clark, H. Cook, J. McIntyre and Mr. Warner have been appointed water commissioners, and will take preliminary steps towards the construction of works.

DELEVAN, N. Y.—The works have been purchased by a syndicate, composed of 30 residents of this village, as a step towards municipal ownership.

ELMIRA, N. Y.—Some of the business men of this city are reported as making efforts to have the city construct new works. There has been talk for some time of purchasing the present plant.

MIDDLEVILLE, N. Y.—The following bids were received Aug. 15 for constructing works, as advertised in Engineering News.; C. W. Hamlin, Pres. Comrs.; W. A. Dickins, Secy. Comrs.:

For labor:	
Driscoll Bros. & Reed, Ithaca, N. Y.....	$9,311.62
Wm. T. O'Connor & Co., Syracuse, N. Y...	11,097.66
John Marsden, Utica, N. Y.....	11,440.50
Gregory & Lardner, Coxsackie, N. Y.....	11,661.82
Hendricks, Taylor & Warner, Northampton,	12,012.00
Beckwith & Quackenbush, Herkimer, N. Y.	12,567.78
A. F. Nims, Philadelphia, N. Y.....	13,080.86
John J. Seigrist, Utica, N. Y.....	13,364.30
Flood & Sherrill, Sandy Hill, N. Y.....	13,642.50
John White, Utica, N. Y.....	13,994.86
Smith Bros., Pelhamville, N. Y.....	14,275.12
Michael Bennett, Utica, N. Y.	14,297.94
John Morrell, Mohawk, N. Y.	15,162.54
Seymour & Banker, Gloversville, N. Y. ..	15,175.52
For pipe:	
Charles Millar & Sons, Utica, N. Y.....	$4,085.25
Driscoll Bros. & Reed, Ithaca, N. Y.	4,401.30
Warren Foundry & Machine Co., New York	4,427.97
R. D. Wood & Co., Philadelphia, Pa.	4,445.57
Jackson & Woodin Mfg. Co., Berwick, Pa.	4,596.77
McNeal Pipe & F'dry Co., Burlington, N.J.	4,706.85

MONTICELLO, N. Y.—The contract for completing the works has been awarded to J. H. Riley, of New York. The Wild Engineering Co., Valatie, N. Y., discontinued work on the plant some time ago.

NEW YORK, N. Y.—Bids are asked until Aug. 30 for laying water mains in about 20 streets and for constructing tunnel, tower, pier and appurtenances at the new high-service works. Wm. Brookfield, Comr. Pub. Wks.

NYACK, N. Y.—The recently appointed water commissioners have recommended that the present plant be purchased or new works constructed. A special election will be held Sept. 3 to vote on the question. Jas. S. Haring, Engr.; E. H. Cole, Village Clk.

PAWLING, N. Y.—D. Cuozzo, 386 Broome St., New York, has been awarded the contract for building the reservoir and completing the works. The contract for works was originally awarded to the Wild Engineering Co., but the work was discontinued, as noted in our issue of last week.

ROCHESTER, N. Y.—Local papers state that the New York Central R. R. Co. and the brewing companies are considering plans for securing an independent water supply, owing to the large sums now paid for city water.

WHITESBORO, N. Y.—H. S. Patten is interested in a proposed water company at this place.

YORKSHIRE, N. Y.—It is reported that Geo. N. Cohen has been granted a franchise for works at this place and other villages in Cattaragus and Wyoming counties.

FRANKLIN, N. J.—The township committee has closed an agreement for the purchase of the plant of the Nutley Water Co., subject to a vote of the people Aug. 21. The supply will be from the East Jersey water mains.

LAMBERTVILLE, N. J.—The board of health is investigating the water supply, and it is reported that the water company intends putting in a filter plant.

TOM'S RIVER, N. J.—Press reports state that Ferris & Richards, of Jersey City, have made a proposition for a Jersey City syndicate to construct works and an electric light plant at this place.

CARLISLE, PA.—The Boiling Springs Water Co. has submitted a proposition for supplying this place with water and the council is considering the offer. J. C. Bucher is president, and H. T. Duke manager of the water company.

CATASAUQUA, PA.—The Crane Water Co. was incorporated Aug. 14 with a capital stock of $50,000, commencing with $5,000. Treas., Jas. M. Hodge, of Philadelphia. Leonard Peckitt and A. N. Ulrich, of this place, are interested.

CORRY, PA.—The council has been perpetually enjoined from carrying out the contract awarded some time ago to J. F. Witmer, of Buffalo, N. Y., for works.

ELIZABETHTOWN, PA.—The Elizabethtown Water Co. has commenced the construction of wells for its new works, for which Edgar B. Kay, of Bellwood, Pa., is preparing plans.

GROVE CITY, PA.—The Grove City Water Co. was incorporated Aug. 15 with a capital stock of $10,000, commencing with $1,000. Treas., A. E. Graham, Grove City. I. C. Keller and J. M. Martin are also interested.

KENNETT SQUARE, PA.—Bids are asked for the construction of a 30 x 30-ft. iron stand-pipe. M. P. Davis, Chn. Com.

LESTERSHIRE, PA.—It is stated that works will soon be constructed in this village.

MECHANICSBURG, PA.—The Cumberland Water Co., of Boiling Springs, is reported to have made a proposition to supply this place with water.

MONTEREY, PA.—The Monterey Water Co., of Monterey, Washington township, Franklin county, Pa., was incorporated Aug. 15, with a capital stock of $5,000, commencing with $500. This project was noted Aug. 1, under Hagerstown, Md. A. Morris Carey, 26 Leight St., Baltimore, Md., was one of the incorporators.

MYERSTOWN, PA.—Construction of works at this place has been commenced. Engr., Edgar B. Kay, of Bellwood, Pa.

ROCHESTER, PA.—James P. Leaf, Cy. Engr., is preparing plans for a water supply. It is proposed to secure a filtered supply from the Ohio River.

WESTFIELD, PA.—The citizens of this place are reported to have offered to purchase the works from the borough for $20,000, and to extend the system so as to cover the whole borough.

BALTIMORE, MD.—Local papers state that as the city cannot extend its supply beyond the city limits, a company is being formed to construct independent works at Govanstown. Col. L.B. McCabe is interested.

CANTON, MD.—Frank Long, of this place, has been awarded the contract for laying about 27,000 ft. of 10-in. pipe for the Chesapeake Electric & Water Co., which proposes to supply residents of this place and Highlandtown.

BRISTOL, VA.—Bids are being considered for a new reservoir. J. A. Stone, Clk. of Council.

MERIDIAN, MISS.—A. A. Tucker, of Memphis, Tenn.; Prof. C. M. Strahn, of Athens, Ga.; H. M. Hartman, of Pittsburg, Pa., and F. V. Brown, of Chattanooga, Tenn., are four of the five appraisers selected to fix a value upon the works which the city is about to purchase.

BLUFFTON, O.—W. H. Fuller is reported as chairman of the committee that is investigating the question of works at this place.

HURON, O.—T. W. Derry, Clk., writes us that works will not be constructed this year.

LAKEWOOD, O.—Bids are asked until Sept. 11 for furnishing material and laying a 10-in. water main. Engr., N. B. Dare, 677 The Arcade, Cleveland; Wm. F. Closse, Clk.

NORWALK, O.—At the special election Aug. 13 the citizens voted to issue $100,000 in bonds for the proposed new works east of the city.

ST. MARY'S, O.—M. J. Mooney, Jr., Clk., writes us that water-works trustees will be elected this week.

WESTWOOD, O.—The clerk has been authorized to advertise for bids for the purchase of $20,000 of water-works bonds, and it is stated that the mains will be laid at once.

YOUNGSTOWN, O.—Bids are asked until Sept. 2 for a supply of pipe, hydrants, valves, lead, etc., and until Sept. 16 for two 5,000,000-gallon pumping engines, as stated in our advertising columns. D. N. Simpkins, Secy. W. W. Trustees.

ALEXANDRIA, IND.—The Alexandria Water-Works Co. has been incorporated with a capital stock of $5,000.

EVANSVILLE, IND.—Bids are asked until Sept. 3 for furnishing materials and building three lines of cast iron intake pipe, and also for building a pump well and engine foundation, as described in our advertising columns. Peter Hermann, Chn. Trustees.

LENOX, MICH.—The citizens have voted to issue $4,000 in bonds for works, which will be constructed at once.

MILFORD, MICH.—Geo. P. McCoy, Village Clk., writes us that the specifications will not be made until a water supply is found. Efforts are now being made to secure this from wells. W. W. Crippen, Pres. Comrs.

MARLETTE, MICH.—Bids are asked until Aug. 31 for the purchase of $14,000 of water bonds. H. C. Morris, Clk.

OWOSSO, MICH.—George M. Edwards, of Owosso, has been awarded the contract for constructing a reservoir, at $5,500. Fred Edwards, Secy. Bd.

PETERSBURG, MICH.—H. F. Woolfe, Clk., writes us that no steps have yet been taken toward securing works at this place; population, 400.

BUDA, ILL.—A press report states that works will soon be in operation at this place.

GENOA, ILL.—H. A. Perkins, Village Clk., writes us that the water-works proposition was defeated at the election Aug. 6, and that nothing further will be done this year.

JACKSONVILLE, ILL.—The officials of the deaf and dumb institution are reported as completing arrangements for putting in works with a capacity of 600 gallons per minute.

LAWRENCEVILLE, ILL.—It is stated that the proposed works will probably cost about $10,000. Will Tracy, Cy. Clk.

LOCKPORT, ILL.—The village board has rejected the bids recently received for works, and W. S. Shields, of Chicago, is preparing new plans and specifications. Leon McDonald, Pres.

LANCASTER, WIS.—Bids are asked until Aug. 31 for the construction of works, as described in our advertising columns. This postponement of date from Aug. 22 has been caused by the delay in the completion of the specifications. August Michaelis, Cy. Clk.

ANAMOSA, IA.—The water company is reported about to sink a well at the prison.

ARMSTRONG, IA.—Bids are asked until Sept. 17 for the construction of works, as noted in our advertising columns. Engr., Chas. F. Loweth, St. Paul; Geo. Stickney, Chn. Com.

DUBUQUE, IA.—The council is considering the construction of a reservoir on Summer Hill.

LAWLER, IA.—James Cunan, Recdr., writes us that plans and specifications may be ordered next month for works to cost $4,000. The plant will include a stand-pipe, about 2,400 ft. of mains, 12 hydrants, etc., and will probably be constructed in October of this year, or May of next year; population, 500.

OXFORD JUNCTION, IA.—Plans for works are being prepared by Crellin & Lovell, of Des Moines. Chas. A. Seaton, Recdr.

ROCKWELL CITY, IA.—T. C. Gregg, Mayor, writes us that $7,000 of water bonds have been sold for $7,308 and that Frank Turner, of Des Moines, has been engaged to purchase materials and superintend the construction of works.

MILACA, MINN.—This village is reported to have voted to issue bonds for works and electric lights.

PRINCETON, MINN.—At a special election Aug. 12, the water-works proposition was defeated.

SPRING GROVE, MINN.—S. H. Ellestad, Village Recdr., writes us that the Challenge Wind Mill & Feed Mill Co., of Batavia, Ill., is preparing plans for works which will include a well 400 ft. deep, wooden tank on a 60-ft. steel tower, 5-HP. gasoline engine, 1,100 ft. of 8 and 6-in. mains, 5 hydrants, etc. O. B. Nelson, Chn. Com.

HERINGTON, KAN.—The Herington Water, Light & Power Co., was incorporated Aug. 10, with a capital stock of $25,000 by T. M. Bixby, W. S. Morgan and H. S. J. Towner, of this place, and Theodore Stegner and F. C. Burroughs, of Kansas City, Mo.

OMAHA, NEB.—The receivers of the water company have been authorized to spend $85,000 for extending and enlarging the mains.

NACOGDOCHES, TEX.—J. H. Thomas, Cy. Clk., writes us that there is some talk of constructing works but that a majority of the property owners seem opposed to the town issuing bonds, and it is not probable that anything will be done at present; population, 1,500.

TACOMA, WASH.—The council has voted to purchase the water rights of Clover Creek, Spanaway and Bushaker Creek and Spanaway Lake to secure an additional water supply of 4,000,000 gallons a day.

LOS ANGELES, CAL.—The Highland Water Co. was incorporated Aug. 12 with a capital stock of $100,000, commencing with $52,800. E. A. Winans, Joy A. Winans, D. R. Brearley and others of Los Angeles were incorporators.

SAN JOSE, CAL.—The San Jose Water Co., which supplies this city and Santa Clara, is extending its service to Los Gatos. Pres., W. D. Tisdale.

SANTA CLARA, CAL.—The San Jose "Mercury" states that J. F. Sims, Pres. General Construction Co., has signed a contract for the construction of works at this place, to cost $40,000.

VACAVILLE, CAL.—W. W. Fitch has reported that the new works will cost $23,074, exclusive of land, according to reports.

BRACEBRIDGE, ONT.—Bids were received until Aug. 21 for the purchase of $6,000 of water extension bonds.

OTTAWA, ONT.—The Gatineau Point council is considering propositions for granting a franchise for works.

TORONTO, ONT.—The Georgian Bay Aqueduct Co. is having plans made for its proposed canal and aqueduct, noted last week.

IRRIGATION.

SANTA FE, N. MEX.—Press reports state as follows: Information has been received here that the Smith and Boyd projects have been practically consoli-

dated and placed in the hands of C. B. Eddy, who undertakes to finance the scheme. A dam is to be built across the Rio Grande River near old Fort Selden, from which ditches will extend south to El Paso, irrigating valley lands on either side of the river for a distance of 40 miles.

NEW COMPANIES.—Bexar Irrigation & Canal Co., San Antonio, Tex.; $18,000; Edward Truehart, C. K. Crawford.

Almeria Irrigation Canal Co., Almeria, Neb.; $10,000; R. D. Williams, Archibald Balls, R. S. Replogh, Wm. A. Clark, J. A. Beals.

Kaweah Irrigation & Power Co., Visalia, Cal.; $300,000, full amount paid in; Elisha C. Wave, Chicago, Ill.; A. G. Wishon, Tulare, Cal.; George Hanna, Los Angeles; O. C. Ainsworth, Pasadena, Cal.

Granite Water Co., Los Angeles, Cal.; $30,000, with full amount paid in; to construct canals, aqueducts, etc., for irrigation purposes; Lewis Rudolph, of Lamanda Park; C. Greene, of Pico Heights; Michael Luy, Palms; Lewis Gottscholk, of Los Angeles.

SEWERAGE.

THE CLOACA MAXIMA AT ROME.

CAMDEN, ME.— The board of health has recommended the extension of the system.

BRISTOL, N. H.—Eugene N. Sanctuary and H. M. McIntosh, Cy. Engr., both of Burlington, Vt., are making surveys of this village with a view to the construction of a sewerage system.

BOSTON, MASS.—The following bids for building a sewer and connections in Section 1, Columbus Ave., Wards 18 and 19, have been received by the superintendent of streets: H. P. Nawn, $15,448; Collins & Ham, $16,601; F. A. Snow, $16,091; D. O'Connell, $15,062; Quimby & Ferguson, $12,763.

LEICESTER, MASS.—Bids are asked until Aug. 24 for constructing 6,075 ft. of 10 to 6-in. pipe sewers. Engrs., Geo. A. Craig & Son, Spencer, Mass.

SPRINGFIELD, MASS.—The state board of health has been petitioned to allow the city to extend the Worthington St. sewer a distance of 200 ft. into the river by the construction of a 24-in. pipe. Bids will be asked as soon as permission is granted.

DANBURY, CONN.—Plans are being considered for constructing a downward intermittent filtration system of sewage disposal at an estimated cost of from $75,000 to $150,000. , Engr., W. H. Burchard.

COLLEGE POINT, N. Y.—The trustees have voted to build a 36-in. sewer in Fourth Ave. at an estimated cost of $7,000.

ROCHESTER, N. Y.—The engineer has been directed to prepare plans for extending the west side sewer for a distance of 3,000 ft.

ORANGE, N. J.—It is reported that the city engineer has figured up the bids for the completion of the sewer system, as advertised in Engineering News, the successful bidders being Dowd & McCarthy. The prices for all 12-in. work on the big storm sewer reached the total of $83,193, while for 12-in. arch and 8-in. invert, the figures are $82,490. These prices are considered so low that doubt is expressed as to the ability of the bidders to do the work at these prices. Work will probably begin on the system soon after Sept. 1.

ALLEGHENY, PA.—The council has voted to appropriate $400,000 for sewers and streets. Robt. McAfee, Dir. Dept. Pub. Wks.

EDGEWOOD, PA.—Bids are asked until Aug. 26 for constructing about 27,000 ft. of 20 to 8-in. pipe sewers. Engr., R. L. Smith, 806 Carnegie Bldg., Pittsburg.

PHILADELPHIA, PA.—The following contracts have been awarded for constructing sewers amounting to $224,000: Allegheny Ave., $30,000, J. Sellers Kite & Co.; American St., $8,500, R. P. Bennis; Chew St., $10,500, E. Bennis; George's Run extension, $50,000, J. Sellers Kite & Co.; 56th St., $5,000, K. & D. Dooley; 57th St., $16,000, J. Sellers Kite & Co.; Lefevre St., $9,500, I. H. Hathaway & Co.; Mill St., $19,000, John Bonhage; Milnor St., $18,500, James Sullivan; Ontario St., $15,000, M. McManus; 20th St., $18,000, J. E. Wynkoop; Jasper St., $12,000, H. C. Eyre; Woodland Ave., $12,000, J. Sellers Kite & Co.

RANKIN, PA.—An election is to be held Aug. 27 to vote on the question of issuing $37,000 in bonds for constructing four miles of sewers. W. S. Gordon, Borough Clk.

WILLIAMSPORT, PA.—The question of sewers in Vallamont is being considered.

WILLIAMSPORT, PA.—Bids are asked until Aug. 28 for constructing about 4,000 ft. of 48 to 30-in. brick and 20,600 ft. of 24 to 8-in. pipe sewers,as stated in our advertising columns. George D. Snyder, Cy. Engr.; J. J. Galbraith, Cy. Clk.

WASHINGTON, D. C.—Bids are asked by the district commissioners until Aug. 28 for constructing sewers, as stated in our advertising columns.

SPARTANSBURG, S. C.—It is reported that A. L. Johnson, Mayor, has asked for plans for a system of pipe sewers five miles long, and that an election will soon be held to vote on the matter of construction.

EVANSTON, O.—Bids are asked until Aug. 28 for constructing sewers in two districts. Engr., C. A. Ewing, Carlisle Bldg., Cincinnati; W. H. Krapp, Clk.

FINDLAY, O.—Press reports state that Dr. C. O. Probst, Secy. State Board of Health, and Josiah Hartzell, a member of the board, have completed their inspection of the nuisance created by the emptying of sewers into the Blanchard River at the Main St. bridge, and have ordered that an outlet sewer be constructed to empty into the river a mile below the city.

TOLEDO, O.—The city engineer has about completed plans for a system in Auburndale.

TOLEDO, O.—The city engineer is preparing estimates for a main sewer in Fassett St. and laterals in Ward 6.

INDIANAPOLIS, IND.—Bids are asked until Aug. 27 for constructing about 2,600 ft. of 57 to 20-in. brick and about 1,500 ft. of 6-in. house connections in Indiana Ave., and also for constructing the White River intercepting sewer. The bids for the latter work were received last week, ranging from $6.93 to $16.03 per lin. ft., but were rejected.——The council will receive bids about the middle of next month for constructing 9,795 ft. of the Progue Run intercepting brick sewer, to be 36 to 30 ins. in diameter; for 8,002 ft. of the Capitol Ave. brick sewer, 75 × 50 to 48 × 32 ins., and for 1,615 ft. of pipe sewers in two streets. C. C. Brown, Cy. Engr.

PONTIAC, MICH.—The council has voted to issue $25,000 in bonds for sewers.

CHICAGO, ILL.—Bids are asked until Aug. 28 for constructing a pile outlet in Lake Michigan for the 73d St. sewer. W. D. Kent, Comr. Pub. Wks.

ELKHORN, WIS.—Bids are asked until Aug. 24 for constructing 1¼ miles of 8-in. pipe sewers in Walworth county. D. L. Cowdery, County Clk.

COUNCIL BLUFFS, IA.—The council is considering a proposition submitted by T. J. Evans for changing the course of Indian Creek, which is now used as a sewer, for $40,000.

WAHPETON, N. DAK.—Allen & Osgood, of Fargo, have been awarded the contract for sewers at $4,047.

KANSAS CITY, MO.—Bids are asked until Aug. 26 for extending the O. K. Creek sewer and for constructing a joint sewer. H. H. Filley, Cy. Engr.

ST. LOUIS, MO.—Bids are asked until Sept. 10 for constructinb about 30,000 ft. of 106 to 27-in. brick sewers, and about 105,000 ft. of 24 to 12-in. pipe sewers; 11 contracts. Robt. E. McMath, Pres. Bd. Pub. Improvements; Emory S. Foster, Secy.

BOULDER, COLO.—The council has voted to continue the construction of the system at an estimated cost of $18,000.

WOODSTOCK, N. B.—The people have voted to spend $10,000 for sewers.

GALT, ONT.—It is reported that the question of constructing a system is being considered.

GARBAGE DISPOSAL.

PEORIA, ILL.—The city clerk is corresponding with other cities securing information in regard to garbage disposal plants, and it is reported probable that one will soon be constructed in this city.

DENVER, COLO.—Bids are asked until Aug. 28 for collecting and disposing of the garbage of the city from Sept. 1 to Dec. 31, 1895. W. P. Munn, Health Comr.

STREETS AND ROADS.

HANCOCK, MASS.—The following bids were received Aug. 15 by the Massachusetts highway commission in Boston for 9,000 cu. yds. of excavation, 5,000 lin. ft. of drain, etc., for a road in this town: Hendrick, Taylor & Warner, Northampton, $6,762; John Cobert, Pittsfield (informal); H. I. Simonds & Robert Rice, Pittsfield, $9,617; Martin Murray, Troy, N. Y., $10,425; William H. Magne, West Newton, $8,398; W. T. Davis & Co., Boston, $9,481; John Gallivan, Cambridge, $10,636.

LEICESTER, MASS.—Bids are asked until Aug. 24 for 1,920 sq. yds. of macadam, 6,740 cu. yds. of grading, 2,325 lin. ft. of gutters, etc. Engrs., Geo. A. Craig & Sons, Spencer. Address Wm. A. Bell, Selectman.

ALBANY, N. Y.—T. Henry Dummary has been awarded the following contracts for paving: North Pearl St., granite blocks, $47,871; Chestnut St., brick, $17,679. H. J. Vanderburg has been awarded the contract for paving Third Ave. with granite blocks at $13,085. The itemized bids will be published next week.

BROOKLYN, N. Y.—Bids are asked until Aug. 27 for paving two streets with cobblestones; until Aug. 30 for repaving Clifton Place with asphalt,and until Sept. 4 for repaving three streets with brick. Alfred T. White, Comr. Cy. Wks.

BROOKLYN, N. Y.—Bids are asked until Sept. 4 for repaving three streets with brick, as stated in our advertising columns. Alfred T. White, Comr. Cy. Wks. ——Bids are asked until Aug. 30 for repaving five streets with asphalt; sureties, $3,000 to $10,000; five contracts.

ELMIRA, N. Y.—Bids are asked by the city clerk until Aug. 26 for paving Exchange Place with Medina blocks.

NEW YORK, N. Y.—Bids are asked by the department of docks until Aug. 27 for 2,400 sq. yds. of Belgian block and other paving at Pier 19, North River, and supplying 4,578 gallons of paving cement.——Bids are asked by the department of public works until Aug. 30 for grading and resurfacing two streets, and for building culverts in Ninth Ave. at 201st St.

OLEAN, N. Y.—Bids are asked by the commissioners of public works until Sept. 4 for 26,000 sq. yds. of brick paving, as stated in our advertising columns. C. S. Giles, Cy. Engr.

STAPLETON, N. Y.—Bids are asked until Sept. 3 for 28,600 sq. yds. of macadamizing, etc., as stated in our advertising columns. Henry P. Morrison, County Engr.; Franklin C. Vitt, Clk. Bd. Supervisors.

SYRACUSE, N. Y.—Bids are asked until Sept. 3 for paving four streets with brick, asphalt or sandstone blocks; check, $2,000. H. C. Allen, Cy. Engr.; H. F. Stephens, Cy. Clk.

WHITE PLAINS, N. Y.—Bids are asked until Aug. 24 for about 10,000 sq. yds. of brick paving, 5,000 lin. ft. of curbing, 1,000 ft. of 24-in. drain pipe, etc. The legislature authorized the appropriation of any sum not in excess of $50,000 for the work. Wm. B. Sutherland, Village Clk.

NEWARK, N. J.—Bids are asked until Aug. 29 for 28,300 sq. yds. of brick paving, as stated in our advertising columns. Ernest Adam, Cy. Engr.; J. Crowell Mundy, Gen. Supt. of Works.——Thos. J. Regan has been awarded the contract for paving Belmont Ave. with granite blocks at $53,355; John F. Shanley, Boyd St., trap rock, $17,426; Barber Asphalt Paving Co., Bruce St., $36,040; New Jersey Asphalt Paving Co., Lafayette St., $45,560.

ALLEGHENY, PA.—The council has voted to spend $400,000 for paving and sewers.——The Minerva Paving Co. has been awarded the contract for 333,000 paving brick.

CRAFTON, PA.—The council has awarded the contract for paving with brick and constructing sewers in six streets to the Filbert Construction Co., of Pittsburg, at $54,000.

PHILADELPHIA, PA.—Bids are asked until Aug. 27 for grading, paving, etc., a number of streets. Thos. M. Thompson, Dir. Dept. Pub. Wks.

WILLIAMSPORT, PA.—Bids are asked until Aug. 28 for repaving Pine St. with asphalt or brick and for paving Mulberry St. with asphalt, as stated in our advertising columns. George D. Snyder, Cy. Engr.; J. J. Galbraith, Cy. Clk.

WASHINGTON, D. C.—Bids are asked until Aug. 24 for grading the Falls, Church and Georgetown road at Dyes' Hill, Alexandria county. A. B. Grunwell, Chn. Bd. Supervisors, 1515 30th St. N. W., Washington.

LOUISVILLE, KY.—Bids are asked until Aug. 30 for paving portions of 27 streets with brick and grading and improving two others. J. Henry Hoertz, Secy. Bd. Pub. Wks.

CINCINNATI, O.—Bids are asked by the board of administration until Sept. 5 for constructing artificial stone sidewalks.

EVANSTON, O.—Bids are asked until Sept. 11 for improving two streets; two checks of $500 each. Engr., Chas. A. Ewing, Carlisle Bldg., Cincinnati, O.; Wm. H. Krapp, Clk.

OXFORD, O.—Bids are asked until Aug. 27 for improving two streets. J. A. Kennedy, Clk.

PLEASANT RIDGE, O.—Bids are asked until Sept. 2 for paving Glos Ave. with brick; surety, $1,000. Engr., J. M. Harper, Ninth and Plum Sts., Cincinnati, O.; Robt. T. Hutton, Clk.

ZANESVILLE, O.—Bids are asked until Aug. 24 for constructing sidewalks and improving portions of 15 streets. Chas. N. Bainter, Cy. Clk.

EVANSVILLE, IND.—The department of public works is preparing to pave over two miles of streets with brick.

INDIANAPOLIS, IND.—Bids are asked until Aug. 27 for 820 lin. ft. of brick sidewalk; 4,700 lin. ft. of grading and graveling in two streets; and 10,035 sq. ft. of cement sidewalk, and until Aug. 31 for about 38,000 sq. ft. of cement sidewalk and about 20,000 sq. ft. of brick sidewalk, etc. Chas. C. Brown, Cy. Engr.

LOGANSPORT, IND.—Bids are asked until Sept. 2 for paving Fifth St. with brick. John B. Winters, Cy. Clk.

DETROIT, MICH.—The board of public works for the second time has rejected the bids for paving Cadillac Square, and has again decided to advertise for new bids for the work. Otto Guelich's bid was $23,704; Barber Asphalt Paving Co., $23,883. The Warren-Scharf Asphalt Paving Co. was the lowest bidder, at $21,263, and all future bids must be within this one.

BELLEVILLE, ILL.—The Abbot-Gamble Co., of St. Louis, Mo., has been awarded the contract for paving West Main St. with brick at $12,008.

DE KALB, ILL.—Bids are asked until Sept. 7 for grading and paving 13,600 sq. yds. of Main St., as stated in our advertising columns. Consult. Engr., L. B. Merriam; D. D. Brown, Mayor; E. A. Porter, Cy. Clk.

PEORIA, ILL.—The committee has decided to pave next year portions of 34 streets, or about 15 miles, with brick or asphalt.

QUINCY, ILL.—The board of public works has voted to advertise for bids for paving three streets with brick.

IOWA CITY, IA.—James Carrs, ex-Cy. Engr. Des Moines, has completed plans for landscape gardening for the estate of W. F. Main. The work will include drives, walks, etc.

OMAHA, NEB.—Bids are asked until Sept. 5 for 3,500 cu. yds. of grading. Fred J. Sackett, County Clk.

KANSAS CITY, MO.—Bids are asked until Aug. 26 for improving a number of streets and paving one with brick. H. H. Filley, Cy. Engr.

ELORA, ONT.—Bids are asked until Aug. 30 for 10,000 sq. ft. of artificial stone sidewalk. Frank Clark, Reeve; Alexander Petrie, Clk.

OTTAWA, ONT.—The council has decided to at once advertise for bids for paving Rideau St. with asphalt, the contractor to deposit a check of $1,000.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

FIRE ENGINES.—Newark, N. J.—The fire commissioners have voted in favor of purchasing six more fire engines.

STREET SWEEPING.—Indianapolis, Ind.—Bids will be asked next month for sweeping all improved streets for a term beginning Nov. 1.

TURNOUTS.—Boston, Mass.—N. C. Mills wants to correspond with firms selling turnouts. Address in care of Carson Trench Machine Co.

FIRE ALARM BOXES.—Brooklyn, N. Y.—Bids are asked until Aug. 30 for 100 fire alarm signal boxes. F. W. Wurster, Comr. Fire Dept.

SEA WALL.—Revere, Mass.—Bids are asked until Friday evening, Aug. 23 for building a granite and rubble stone sea wall. Alfred S. Hall, Chn. Com.

SALE OF CANAL.—Annapolis, Md.—Bids are asked until Oct. 9 for the purchase of the state's interest in the Chesapeake & Ohio canal. Frank Brown, Pres. Bd.

ELECTRIC TRAVELING CRANE.—St. Louis, Mo.—Bids are asked until Sept. 6 for a 20-ton electric traveling crane for high service pumping station No 3. E. S. Foster, Secy. Bd. Pub. Impvts.

DAM.—Madison, Me.—The contract for building a new stone dam, as noted last week, has been awarded to J. N. Merrill and J. A. Greenleaf, of Bangor and Auburn, Me. The work will cost about $20,000.

DAM.—Monson, Me.—The Long Pond Dam Co., recently incorporated, has perfected its organization and will rebuild the dam at Long Pond, and improve the stream. Pres., Onar Clark; Clk., J. F. Sprague.

SALE OF DREDGE, ETC.—Newport, R. I.—Bids are asked until Sept. 19 for the purchase of a tug, dredge, etc., from the United States, as stated in our advertising columns. 1st Lieut. W. W. Harts, U. S. Engr. Office.

REMOVAL OF WRECK.—Washington, D. C.—Bids are asked until Sept. 17 for the removal of wreck of steamer "Lady of the Lake," in Washington channel of Potomac River. Maj. Chas. E. L. B. Davis, U. S. Engr.

EXCAVATING CHANNEL.—Lafayette, Ore.—Bids are asked until Aug. 24 for excavating a channel 40 ft. wide in Yamhill River. The work will include the removal of 6,612 cu. yds. of solid rock. T. H. Dupuy, Cy. Recdr.

CONDUCTORS AND UNDERGROUND CABLE.—Buffalo, N. Y.—Bids are asked until Aug. 26 for 6,365 ft. of 24 conductor cable, 3,200 ft. of 20, 2,325 ft. of 8 and 2,405 ft. of 4 conductor cable. John G. Bilz, Clk. Bd. Police.

PIER.—Boston, Mass.—The Boston, Lynn & Nantasket Steamboat Co. has purchased land at Nantasket Beach, opposite the Surfside House, where it is stated a pier and head house will be built for the season of 1896.

GAS PIPE, ETC.—Philadelphia, Pa.—Bids are asked until Aug. 28 for 2,500 lengths of 4-in. cast iron pipe, 2 turntables, and 2 Bronder patent charging machines with appurtenances at Point Breeze works. Thomas M. Thompson, Dir. Pub. Wks.

STEAM ENGINES.—Milwaukee, Wis.—Press reports state that the water of the Fox River is so low that manufacturers at Neenah, Menasha, Appleton, Kaukauna, Depere and other towns in the Fox River valley will be obliged to purchase steam engines to use in place of water power.

SUBWAY.—Boston, Mass.—Bids will probably be opened Sept. 3 for section 2 of the subway, the Boylston St. station. The work will include about 60,000 cu. yds. of excavation, 9,000 cu. yds. of concrete masonry, 1,000 cu. yds. of brick masonry, and 1,350 tons of iron and steel work. The specifications are expected to be ready this week. H. A. Carson, Ch. Engr., 20 Beacon St.

DREDGING AND PIER WORK.—New York, N. Y.—Bids are asked by the department of docks until Aug. 27 for 200,000 cu. yds. of mud dredging in the North River between the Battery and West 34th St., 100,000 cu. yds. north of West 34th St., and 100,000 cu. yds. in the East and Harlem rivers, and also for furnishing sawed yellow pine timber and for repairing the pier at the foot of West 20th St.

CANAL.—Sault Ste. Marie, Mich.—An Eastern syndicate, represented by F. H. Clergue, purchased on Aug. 14 the right of way of the old St. Mary's Falls Water Power Co., which, after expending $250,000 on the canal, seven years ago, stopped work on account of the lack of funds. The amount paid was $70,000. The work of developing the canal will be at once resumed. A large pulp and paper plant will be constructed by the syndicate.

HARBOR WORK.—Mexico, Mex.—A press report from this city states that a commission of seven engineers appointed by the department of communications to inspect the terminal ports of the Tehuantepec Ry. has compiled its report, which will soon be published. The report suggests jetties to deepen the bar at Coatzacoalcos River, at a cost of $4,000,000, and at Salina Cruse a system of breakwaters costing several millions. Plans are submitted for land-locked harbors at Juchitan Lake, 30 kilometers south of Salina Cruse, as preferable to breakwaters at that port. The cost of converting the lake into a harbor and excavating a canal from it to the ocean is estimated at $10,000,000. The government will soon decide whether it will give out the work to contractors or do it itself.

CANAL IMPROVEMENTS.—Albany, N. Y.—Contracts for public works have been awarded as follows: For the improvement of the Albany basin by removing wrecks and deepening that section lying south of the Columbia St. bridge, to P. W. Myers & Son, at $9,513. The other bidders were: John P. Randerson, Albany, $12,348; E. M. Payne, Albany, $10,029; P. J. Brummelkamp, Syracuse, $12,000. For the widening of the cemetery culvert on the Champlain canal at Waterford, to Ira Parker, of Waterford, at $1,812; rebuilding of a portion of combined locks Nos. 39, 40, 41, 42 and 43 on the Black River canal, to Dodge & McGregor, of Buffalo, at $38,881; repairing a berm bank of the Champlain canal at Schuylerville, to Cunningham & Monty, of Sandy Hill, at $6,940; rebuilding of sea wall between East Marion and Orient, Suffolk county, to P. J. Brummelkamp, of Syracuse, at $10,-105; repairing of breakwater protecting the entrance to the canal feeder at Owasco Lake outlet, dredging of channel and repairing of dam and gates at dam No. 1, to John M. Hallock, Syracuse, at $8,842; for improving the channel of the Seneca River and Old Bear race at Waterloo, to George W. Barlow, of Seneca Falls, at $7,837.

MANUFACTURING PLANTS.

FAIRFIELD, ME.—Press reports state that the saw mills of G. A. Phillips & Co., Sanye & Co., and N. T. Coleman & Son have been destroyed by fire; loss, $125,000; insurance, $38,000.

NEW BEDFORD, MASS.—The Dartmouth Mfg. Co. has been organized with a capital stock of $500,000; Pres., Rufus A. Soule; Clk. and Treas., Jas. W. Allen.

PEABODY, MASS.—The Vaughn Machine Co., of South Peabody, is to enlarge its plant by the erection of a foundry; one-story, 90 x 30 ft. Pitman & Brown, of Salem, have the contract for the building.

SCHENECTADY, N.Y.—The General Electric Co. is reported about to erect new buildings at a cost of $200,000.

CAMDEN, N. J.—Press reports state that five buildings, each six stories in height, are to be built for Adolph Segal, for sugar-refining purposes, at Penn St. and the river front. Plans have been completed and bids will be received by T. H. Muller, Arch., Philadelphia, Pa. The entire plant will cost $2,000,000.

PITTSBURG, PA.—Press reports state that five new blowing engines, costing in the aggregate about $60,000, will be erected by the Carnegie Steel Co., at its Edgar Thomson furnaces to furnish additional blast power. A new engine house will also be erected.

READING, PA.—Howard L. McIlvaine, Louis Crater, Chas. A. High, Morton M. Crater and Walter S. Youngs are reported about to apply for a charter for the Reading Tin Plate Co.

UNIONTOWN, PA.—At a meeting in this city Aug. 13 it was decided to erect at once the proposed glass works at Point Marion. The plant will cost about $150,000, and give employment to about 600 men. Among those interested are W. K. Maple, T. J. Kelser, C. K. Saddler and Chas. A. Conn, of Point Marion; M. G. Collins, Henry Sheets, George Woodhull and Theo. Allen, of Charlerol, and Geo. A. Marsh, of Sandusky, O.

CARY, N. C.—T. N. Ivey, Business Agent Farmers' Alliance, Raleigh, N. C., reports that the state alliance will erect several manufacturing plants at an early day, probably at Cary, N. C., including a large shoe manufacture a roller flour mill, a fertilizer factory, and a woolen mill. The shoe factory will probably be built first and $30,000 is already in hand for the purpose. Address T. N. Ivey, Raleigh, N. C.

CHARLOTTE, N. C.—Lee H. Battle, of the Fidelity Bank, Durham, N. C., and T. W. Harris, late of the American Tobacco Co., now also of Durham, are building a roller flour and grist mill on an extensive scale at this place. The machinery has not yet been purchased. It will be operated by steam power.

SELMA, ALA.—It is stated that $100,000 has been subscribed for a new cotton mill at this place and that the construction will be commenced at once.

MASSILLON, O.—Plans and specifications have been prepared for a brewery and artificial ice plant to be erected by Echard & Schimk Brewing Co., according to press reports.

ANDERSON, IND.—The National Tin Plate Co. is reported about to build a bar mill in connection with its plant.

ATLANTA, IND.—The Atlanta steel and tin plate factory is to be enlarged at once, according to press reports.

MUSKEGON, MICH.—J. J. Connell & Co., of Chicago, have commenced the construction of a factory for the Amazon Hosiery Co. The work will require 280 cords of stone and 1,551 M. brick and the building will cost $35,500. J. J. Connell, F. W. Connell and J. W. Grandfield compose the firm of J. J. Connell & Co.

CHICAGO, ILL.—It is stated that the Illinois Steel Co., after having given the two new Wellman rolling furnaces a thorough trial, has decided to erect four more furnaces of the same style. The basic process will be used.

CONTRACT PRICES.

BRICK PAVING.—Michigan City, Ind.—Albert H. Leist, Cy. Clk., writes us that the contract for paving William St. has been awarded to C. A. Valentine, at $1.22 per sq. yd. for Poston blocks.

BRICK AND CURBSTONE.—Montreal, Que.—A contract for 7,700 sq. yds. or more of brick has been awarded to the Laprairie Pressed Brick Co., at $1.28 a sq. yd., and a contract for a supply of curbstone to A. L. Desormeau, at 40, 45, and 75 cts. a lin. ft.

DREDGING.—New Bedford, Mass.—The contract for 6,000 cu. yds. of dredging, as advertised in Engineering News, has been awarded the Columbia Dredging Co., of Fall River, Mass., at 32 cts. a cu. yd. Wm. S. Cook, Asst. Cy. Clk.

BRIDGE SUBSTRUCTURE.—Minneapolis, Minn.—The following bids were received Aug. 9, for building the sub-structure of the Seventh St. bridge over the tracks of the Minneapolis & St. Louis and the Great Northern railways:

Bidder.	Masonry, South abutment, cu. yd.	Masonry, Pedestals, cu. yd.	Concrete, cu. yd.	Earth excavation, cu. yd.	Filling, lin. ft.
[1]Macquald & Co.	$6.70	$11.24	$2.80	$0.29	$0.17
B. Aronson	7.75	9.50	3.50	.30	.17
Van Norman & Coughlan	7.40	11.20	4.20	.30	.13½
Charles Stone	7.90	9.00	3.90	.30	.20
Martin Ring	6.25	10.50	3.90	.75	.16
[2]H. Downs & Son	5.50	10.00	3.25	.55	.15
[2]H. Downs & Son	6.25	8.75	3.25	.55	.15
[3]Caney Bros.	6.50	6.50	3.50	.25	.17
[1]Rinker & Hoff	7.25	11.50	3.95	.50	.24
[2]Rinker & Hoff	6.75	10.00	3.95	.50	.24
D. D. Smith & Co.	6.00	10.00	3.75	.50	.15

[1] If Kettle River sandstone is used. [2] If Mankato stone is used. [3] Wasioja stone.

ASPHALT BLOCK PAVING.—Hartford, Conn.—The contract for paving State St., from Commerce to Market Sts. and Central and American Rows, has been awarded to the Hartford Construction Co., at $3.04 a sq. yd. Hastings' Trinidad Lake asphalt blocks are to be used.

SEWERS.—Swarthmore, Pa.—T. G. Janvier, Engr., Lansdowne, Pa., has sent us the following statement of bids recently received for constructing sewers at this place, the contract for which was awarded Aug. 12 to E. B. Kay at $7,123, as noted in our issue of last week.

Bids Received for Constructing Sewers at Swarthmore, Pa.

Quantities.	F. Starkey, Philadelphia.	M. Honan & Son, Chester, Pa.	J. A. Mundy & Bro., Philadelphia.	Hinden & Holland, Philadelphia.	Patrick Mahoney Kellyville, Pa.	Daniel M. Smart Philadelphia.	Wm. P. Clement, Philadelphia.	John Bonhage, Philadelphia.	J. E. Wynkoop, Philadelphia.	Chas. T. Mears, Philadelphia.	Watson & Bro., Swarthmore, Pa.	R. C. Matlack, Philadelphia.	F. Bartlucci, Philadelphia.	D. J. McBride, Philadelphia.	Johnson & Wickersham, Media, Pa.	Ward & Stocker, Harrisburg, Pa	Edgar B. Kay, Bellwood, Pa.	Hanna & Riley, Chester, Pa.	J. S. Kite & Co., Philadelphia.
10-in. pipe, av. cut, 18 ft., 1,300 ft.	$2.33	$3.05	$4.75	$4.87	$2.80	$3.75	$6.50	$3.80	$3.55	$4.75	$2.70	$2.22	$4.85	$3.00	$4.25	$1.75	$2.20	$4.282	$1.54
10-in. " " " 10 " 475 "	2.33	.49	.65	.48	.50	.53	.35	1.80	.45	1.15	.558	2.22	1.20	1.00	.44	.57	.60	.502	.65
8-in. " " " 4 " 1,925 "	.37	.39	.35	.32½	.40	.48	.36	1.00	.40	.85	.372	.....	.87	.60	.42	.30	.27	.45	.45
6-in. " " " 3¾ " 450 "	.35	.24	.27	.392	.50	.44	.20	.80	.35	.90	.50	.62	.96	.48	.39	.22	.182	.402	.30
6-in. " " " 3¾ " 1,190 "	.35	.23	.27	.312	.30	.44	.20	.55	.35	1.00	.254	.....	.96	.48	.39	.22	.182	.332	.30
6-in. " " " 3¾ " 360 "	.35	.31	.27	.312	.50	.44	.20	.60	.35	.65	.427	.48	.68	.48	.39	.30	.182	.362	.30
6-in. " " " 3¾ " 1,355 "	.35	.23	.27	.312	.30	.48	.20	.60	.35	.75	.368	.48	.78	.48	.39	.21	.182	.30	.30
6-in. " " " 3¾ " 1,245 "	.35	.22	.27	.312	.30	.53	.22	.60	.35	.62	.392	.48	.65	.48	.39	.23	.182	.332	.30
6-in. " " " 3¾ " 1,695 "	.35	.21	.27	.312	.30	.53	.22	.60	.35	.62	.297	.48	.65	.48	.39	.22	.182	.57	.30
6-in. " " " 3¾ " 750 "	.75	.24	.27	.312	.30	.53	.22	.60	.35	.75	.416	.48	.78	.48	.39	.22	.182	.40	.30
6-in. " " " 3¾ " 550 "	.35	.22	.27	.312	.30	.50	.20	.60	.35	.60	.395	.48	.66	.48	.39	.20	.182	.30	.30
Manholes, 18 ft. deep, 4 each	.....	42.00	35.00	.....	40.00	53.00	35.00	40.00	30.00	75.00	75.00	23.00	78.00	40.00	95.00	50.00	40.00	59.00	18.00
" " " 4 " " 16 "	.....	31.00	20.00	22.00	15.00	19.00	14.00	25.00	15.00	35.00	25.00	23.00	36.00	20.00	38.00	50.00	15.00	20.00	18.00
Earth filling 800 cu. yds.	.....	.23	.50	.22	.18	.24	.38	.25	.20	.20	.....	.30	.22	.18	.25	.40	.25	.40	.18
Tanks 2 each	.....	82.00	90.00	130.00	105.00	110.00	115.00	75.00	75.00	75.00	216.00	248.00	76.00	150.00	150.00	75.00	81.00	110.00	175.00
Rocks 75 cu. yds.	.....	5.00	3.50	.....	2.00	3.00	.56	1.50	1.00	1.00	.....	.....	1.00	2.00	1.75	1.00	1.00	3.00	.30
8-in. sewer 100 ft.	.....	.39	.35	.30	.30	.43	.24	.90	.60	.60	.....	.....	64	.30	4.20	.25	.20	.30	.65

ARTESIAN WELL.—Bushnell, Ill.—O. C. Hicks, Cy. Clk., writes us that six bids were received Aug. 3 for sinking an artesian well, as advertised in Engineering News. The contract has not yet been awarded, but it is quite probable that it will be let to O. G. Wilson, of Bellville, Ill., at the following prices: For well 2,000 ft. deep, cased throughout, $2.75 per ft.; 10-in. section, pipe to weigh 40.64 lbs. per ft., probably 100 ft., $2.75; 8-in., pipe 28,177 lbs. per ft., 250 ft., $2.75; 8-in. not cased, $2.25; 6-in., pipe 18,762 lbs. $2.50 per ft.; 5-in., not cased, $2; testing well, $1.50 per hour; no extras to be allowed.

ASPHALT PAVING.—Utica, N. Y.—The Utica Paving Co. will probably be awarded the contract to pave Schuyler St. from Columbia St. to Erie St., using in same best quality Bermudez asphalt or best quality of Alcatraz asphalt, at the following prices: Tile drains, 20 cts. per lin. ft.; resetting curb, 4 cts. per lin. ft.; new curb and setting, 40 cts. per. lin. ft.; catch basins, $30 each; branch pipe, straight, 35 cts. per lin. ft.; branch pipe, curves, bends and branches, $1 each; manholes, $38 each; paving, $1.75 per sq. yd.; repaving, cobble and other stone, 30 cts. per sq. yd.; relaying crosswalks, 4 cts. per sq. ft.; new sandstone crosswalks, back of curbs, 18 cts. per sq. ft.; concrete extra for foundation, $4 per cu. yd.; moving catch basins and furnishing new tops, $14 each; new 12-in. curb next to railway tracks, 25 cts. per lin. ft.; credit, old cobble and crosswalk stone, 10 cts. per sq. yd.

ASPHALT PAVING.—Indianapolis, Ind.—The contract was let Aug. 15 for asphalting Tenth St. to the Warren-Scharf Asphalt Paving Co. at $3.79 a lin. ft. of each side of street. The street is 1,339 x 24 ft. and has 3,912 sq. yds. of 2-in. asphalt on 4-in. concrete, 2,780 ft. of Parkhurst curb, 239 ft. of marginal stone and 10 inlets. Other bids were at $3.87 and $3.94.

ASPHALT PAVING.—Peoria, Ill.—Contracts were awarded Aug. 15 to the Warren-Scharf Asphalt Paving Co. for the construction of asphalt pavements as advertised in Engineering News, as follows: North Jefferson Ave., 29,057 sq. yds. asphalt pavement, at $1.97 per sq. yd. for standard heavy pavement, which price includes all excavation; 13,256 lin. ft. of 7-in. combined curb and gutter, at 85 cts. per lin. ft.; protection curb, 6 cts. per lin. ft.; Crescent Ave., 1,197 sq. yds. asphalt pavement, consisting of 5-in. broken stone concrete foundation and 2-in. asphalt coat, at $1.83 per sq. yd.; for setting stone curb, 7 cts. per. lin. ft., for resetting stone curb, 10 cts. per lin. ft.; for setting protection curb, 6 cts. per lin. ft. A. D. Thompson, Cy. Engr.

BRICK PAVING.—Boone, Ia.—Contracts for paving with two courses of brick were awarded Aug. 7 to J. L. Black & Co., of Omaha, Neb., as follows: 2,392 sq. yds. at $1.31 per sq. yd., including excavation, and 5,166 sq. yds. at $1.34; 1,500 lin. ft. of cement curb at 45 cts. per lin. ft. R. M. Mitchell, Cy. Engr.

ASPHALT PAVING.—Hoboken, N. J.—Bids were opened Aug. 14 for paving portions of three streets with asphalt, the bids for the Hudson St. work being as follows: Patrick Cavanagh, $2.75 per sq. yd.; Barber Asphalt Paving Co., $2.65; Standard Asphalt Co., $2.72; Sicilian Asphalt Paving Co., $2.69; Metropolitan Asphalt Co., $2.74.

BRICK PAVING.—Jackson, Mich.—The contract for paving a portion of Mechanic St. with two courses of brick has been awarded to T. C. Brooks, at $1.43 a sq. yd., provided he will accept some $10,000 in bonds as part payment for the work. The bids were as follows: Conn & Co., Detroit, $1.55; Lake & Stevens, $1.53; Conway & Harrington, $1.73; Casey & Co., $1.45; T. C. Brooks, $1.43.

BRICK SIDEWALKS.—Topeka, Kan.—A contract for 300,000 sq. ft. of brick sidewalks was let Aug. 9 to O. Swanson, at 5.55 cts. per sq. ft., Topeka brick to be used, and the work to be completed by Dec. 10. The other bids were as follows: H. K. Winans, 5.8 cts.; Harry Watson, 5.75 cts; David McNair, 5.68 cts.; C. J. Rosen, 5.64 cts.; John Ritchie, 5.57 cts. Wm. H. Barnes, Cy. Engr.

ASPHALT PAVING.—Niagara Falls, N. Y.—The only bid received Aug. 16 for 2,000 sq. yds. of asphalt paving was submitted by the Barber Asphalt Paving Co., of New York, at $2.57 per sq.yd. for 2½ ins. of asphalt on 4 ins. concrete base; 38 cts. per lin. ft. for curbing taken up, redressed and reset, and 57 cts. per lin. ft. for curbing furnished and set. Willett W. Read, Cy. Engr.

BRICK PAVING.—North Tonawanda, N. Y.—The following bids were received Aug. 13 for 20,000 sq.yds. of brick paving in Payne Ave., as advertised in Engineering News: John Miller, Buffalo, $2.04 per sq. yd.; German Rock Co., Buffalo, $1.99; Louis Gipp, North Tonawanda, $1.80 to $2.10; Edward Brown, North Tonawanda, $1.85; N. Beckrich, $1.92 to $2.14; Buffalo Paving Co., $2.25; Rogers Construction Co., $1.74; A. H. Webster, $1.83; Thomas Tulley, $1.84; Rogers & Ryan, $1.78 to $1.90. The contract has not yet been awarded T. W. Barrally, Engr.

SEWERS.—Indianapolis, Ind.—Contracts have been awarded for the following sewers: In alley east of Broadway, to Sheehan Bros. at $1.87 a lin. ft., other bids ranging from $1.98 to $2.79. The sewer is 1,975 ft. long, has 670 ft. of 24 × 36-in. brick sewer, 2-ring; 712 ft. of 20 × 30-in., 1-ring; 593 ft. of 12-in. pipe, 730 ft. of 6-in. house connections, 6 manholes, 1 lamp hole, 1 flush tank. Sewer in Charles and Palmer Sts., to Wm. Bossert at $2.04 a lin. ft., other bids being $2.17 to $2.85. The sewer is 2,250 ft. long, and has 443 ft. of 26 × 39-in. 2-ring brick, 500 ft. of 24 × 36-in. 2-ring, 260 ft. of 20 × 30-in. 1-ring, 418 ft. of 18-in. pipe, 629 ft. of 15-in., 1,247 ft. of 6-in. house connections, 10 catchbasins, 8 manholes, 105 ft. of 12-in. pipe lateral. Sewer in alley east of College, to Gansberg & Roney, at $1.26 a lin. ft., other bids ranging from $1.30 to $1.72. The sewer is 1,925 ft. long, and has 615 ft. of 18-in. pipe, 692 ft. of 15-in., 618 ft. of 12-in., 450 ft. of 6-in. house connections, 6 manholes, 1 lamp hole and 1 flush tank. Sewer in Alabama St., to Wm. Bossert at $1.45 a lin. ft., the only bid. The sewer is 391 ft. long, and is 12-in. pipe, and has 240 ft. of 6-in. house connections, 1 manhole, 1 lamp hole and 1 flush tank.

INDUSTRIAL NOTES.

THE CHASE PUMP CO., of Canton, O., is moving its works to Columbus, O.

THE HOMESTEAD STEEL WORKS, Homestead, Pa., made a record in July of 43,000 tons of finished material.

T. DORNEY, SON & CO., of Philadelphia, Pa., contractors for street cleaning and other work, have made an assignment.

THE EUREKA CAST STEEL CO., of Chester, Pa., which assigned some time ago, is reported as to resume operations under new management.

THE VIRGINIA IRON & RY. CO. is rehearthing and improving its Rockbridge furnace, at Goshen Bridge, Va., and expects to have it ready to blow in soon.

THE ILLINOIS STEEL CO. has started its Union Mills at Bridgeport, Chicago, giving employment to about 1,400 men. These mills have been closed since 1892.

THE PORTLAND CO., of Portland, Me., has just built a set of engines for the steamer "St. Croix," which are said to be the largest marine engines ever built in New England.

THE PENNSYLVANIA STEEL CO., of Steelton, Pa., turned out over 12,000 tons of steel in its open-hearth department in July, being the largest monthly tonnage in the history of the plant.

THE HARRISBURG BOILER MFG. CO., of Harrisburg, Pa., has completed a steel stand-pipe for the Cumberland Water Co., of Boiling Springs, Pa., and is at work on several other contracts.

THE CONSOLIDATED STEEL & WIRE CO., Beaver Falls, Pa., has started its rod mill and it is reported that the company will rebuild the nail mill and put it and the wire mill in operation soon.

THE POTTSVILLE IRON & STEEL CO., of Pottsville, Pa., is reported about to resume work at its plant, after an idleness of several months. The works will give employment to about 600 men.

THE PRATT & WHITNEY CO., of Hartford, Conn., has awarded the contract for the iron work for its new forging plant to the Berlin Iron Bridge Co., and that for the masonry to Hiram Bissell, of Hartford.

THE PHOENIX BRIDGE CO., of Phoenixville, Pa., has been awarded the contract for the new United States government bridge over the Mississippi River, at Rock Island, Ill., as noted more fully under Bridges.

THE SCHULTZ BRIDGE & IRON CO., of Pittsburg, Pa., has launched a steel transfer barge for the Mississippi River & Boone Terre Transportation Co. It is 274 ft. long and 38 ft. wide, and will carry 16 freight cars.

THE READING IRON CO., of Reading, Pa., is having the Montour Rolling Mills, at Danville, Pa., overhauled and repaired. The mills have been idle several months. When running full they will give employment to over 800 men.

O. P. LOOMIS, of Bound Brook, N. J., is reported as arranging to move his plant to Newport News, Va., where electrical works to manufacture dynamos, motors, etc., will be erected, giving employment to about 100 men.

THE AMERICAN WELL WORKS, of Aurora, Ill., is considering propositions for removing its plant from Aurora to Bloomington or some other city. The company is now capitalized at $300,000, and employs about 200 men.

THE POWER MOTOR & CONCENTRATING CO., has been organized by C. S. Dunphey, of La Grange, Ore., and Pocatello, Idaho, parties, to manufacture the Burns water motor. Several offers are under consideration for the location of the plant.

THE NORDBERG MFG. CO., of Milwaukee, Wis., has just completed a 17,000,000-gallon triple expansion horizontal pumping engine, having a guaranteed duty of 145,000,000 ft.-lbs., for the water-works of Grand Rapids, Mich. The contract was awarded last January.

THE W. S. MERCEREU CROSS-TIE CO., of New York, has contracted for 5,000,000 cross-ties to be made and delivered on the banks of Green and Nolan Rivers in Edmonson county, Ky., within the next few months. The company has opened an office and supply depot at Brownsville, Ky.

THE CHAMPION CAR COUPLER CO., of Kenton, O., has elected the following officers: Pres., G. J. Carter; Vice-Pres., G. W. Austin; Secy., J. L. Simpson; Treas., T. A. Taylor. The company has several contracts already on hand. For the present at least the headquarters will be in Kenton.

THE DETROIT DRY DOCK CO., of Detroit, Mich., is said to have practically closed a contract with the Russian government for the construction of three steel car ferryboats, for Siberia. Each boat will cost at least $800,000. The ice-crushing qualities of the boats now running on the lakes is what called the attention of the Russians to this type of ferryboat.

F. D. CUMMER & SON CO., of Cleveland, O., has been awarded the contract for equipping the new plant of the Wayland Portland Cement Co., recently organized at Wayland, N. Y., with Cummer dryers. F. D. Cummer & Son Co. manufactures rotary dryers for drying marl and clay, also tunnel drying system for drying cement, direct heat being employed for drying.

THE OHIO AUTOMATIC TELEPHONE & SWITCH CO., of Cleveland, O., was incorporated in New Jersey last week, with a capital stock of $250,000. The company will have a factory at Elizabeth, N. J., and will manufacture the Stronger automatic telephone switch. Col. Wm. C. Fogg, Wm. S. Thyng, and Louis H. Allen, of Roselle, N. J., and John W. Lovell, of New York, were the incorporators.

THE PIERPOINT BOILER CO., of Pittsburg, Pa., has been granted a decision in the United States District Court in the case of the Stirling Co. against the Pierpoint Boiler Co., an action for an alleged infringement on a steam boiler attachment, in which the court decides that the alleged infringement was not proven, and ordered that a decree be drawn dismissing the bill.

THE ALABAMA ROLLING MILL, at Gate City, near Birmingham, Ala., is reported as engaging skilled workmen from the North, owing to the rush of business, and as soon as they reach the mill a third turn will be put on. The report also states that the cast iron pipe works in the district have plenty of work on hand, and that at Bessemer the output of the three pipe works consumes every day the output of two blast furnaces.

THE GRANT LOCOMOTIVE WORKS, of Chicago, has completed the first locomotive built since the works were moved to the present location at W. 52d and W. 14th Sts., and purchased by the Siemens & Halske Co., and 12 others are nearing completion. The one completed was built from plans and specifications furnished by the Chicago, Burlington & Quincy R. R. Co., and is designed for either freight or passenger service. It has a total weight of 118,600 lbs., or 192,000 lbs., including a loaded tender.

THE DEAN BROS.' STEAM PUMP WORKS, of Indianapolis, Ind., has removed to its new shops at the corner of First St. and the C., C., C. & St. L. R. R., and now offers its old plant for sale. This is conveniently located at the corner of Madison Ave. and Ray St., four squares south of the Union Station, on the line of the Louisville & Indianapolis R. R.; has sewer connections, artificial gas and natural gas, the latter being supplied for steam boilers and heating purposes at 6 cts. per M. ft. The buildings are all of brick, and were built for foundry and machine shops, but are well adapted to many manufacturing purposes. The engine, boilers and shafting are in place, and could be started at once.

T. H. RISDON & CO., of Mount Holly, N. J., are building for Wm. H. Vinton & Sons, Brattleboro, Vt., three 20-in. D. C. and one 20-in. standard turbine on one horizontal shaft in an iron outer case, two of them discharging into a central draft tube, and one into a quarter turn and draft tube. Each wheel has its gate mechanism arranged to operate independently of the others. The Pejepscot Paper Co., Brunswick, Me., has started its pulp mills, which are driven by 26 Risdon turbines, developing 3,500 HP. under 20 ft. head, and recently awarded the Risdon Co. the contract for two pair of 36-in. horizontal turbines and flumes for its Lisbon Falls mills. T. H. Risdon & Co. are also building for the Wm. L. Gilbert Clock Co., Winsted, Conn., a pair of 30-in. cylinder gate turbines mounted horizontally in an iron flume, with central draft tube. These wheels are of 111 HP. under 18-ft. head.

NEW COMPANIES.—Pittsburg Steel & Iron Co., Pittsburg, Pa.; $200,000, with $20,000 paid in; Treas., E. E. Andrews, Allegheny, Pa.

Kirby Granite Co., St. Johnsbury, Vt.; $10,000; Pres., Geo. W. Handee, Morrisville, Vt.

Davenport Elevator Co., Davenport, Ia.; $50,000; John F. Dow, S. F. Gilman, A. H. Lang.

Calumet Furnace Co., Chicago, Ill.; $50,000; Fred S. Wheeler, Horace K. Tenney and E. J. Towt.

Gratiot Brick & Quarry Co., St. Louis, Mo.; $40,000; W. F. Wangle, Johnston Beggs, W. S. Logan.

Sanders Press Brick Co., St. Louis, Mo.; $20,000; Louis Sanders, William Sanders, Chas. F. Metz.

Lindenwood Brick & Quarry Co., St. Louis, Mo.; to carry on a general sewer pipe business; G. A. Parrish.

Ontario Car & Truck Co., Oswego, N. Y.; $300,000; Chas. Thomson, New York; Geo. W. Harmon, Oswego.

Campbell Oil Co., Wheeling, W. Va.; $7,000; D. M. Campbell, C. F. Bachman, Lawrence Zarnits and others.

Southfield Oil & Gas Co., Wheeling, W. Va.; $5,000; William Forsythe, C. W. Appenzeller, T. W. Lemmon and others.

Fletcher & Barrett Construction Co., St. Louis, Mo.; $10,000; to quarry and construct streets; Thos. E. Barrett, Patrick J. Fletcher.

Reading Tin Plate Co., Reading, Pa.; Howard L. McIlvaine, Louis Crater, Chas. A. High, Morton M. Crater, Walter S. Young.

Fletcher & Barrett Construction Co., St. Louis, Mo.; $10,000; to do a general quarry business; P. J. Fletcher, T. E. Barrett, Wm. J. Fletcher.

German-American Gutta-Percha Fuse Works, Chicago, Ill.; $200,000; C. M. Wilmerding, Wm. B. Pickels, 1502 Monadnock Bldg.; H. H. Fielding, and others.

Electric Construction Co., New Britain, Conn.; $5,000; to wire private dwellings, to put in telephones, electric bells, etc. Secy., I. W. Fish; H. B. Horne.

Snow Melting Co., New York, N. Y.; $10,000; to manufacture machines to melt snow; Wm. McM. Speer, Amasa J. Parker, Jr., John J. Hughes, Albany.

American Power & Tide-Wheel Co., San Francisco, Cal.; $900,000; G. E. Alexander, Sacramento; Charles Bovone, Marcus S. Leve, A. H. Ste. Marie, R. M. Clements, San Francisco.

Cortland Forging Co., Cortland, N. Y.; $100,000; to manufacture carriage forgings and hardware; directors, David F. Wallace, J. H. Wallace, E. P. Taylor and others, of Cortland.

Composite Type Bar Co., New York, N. Y.; $25,000; to manufacture typemaking and typesetting machinery; Caleb H. Jackson, New York; Lucien A. Brott, Geo. A. Kay, Marcus Marx, Brooklyn.

WE WANT.

We want more news from your vicinity. We want more news items in regard to projected work in which you are interested. We want you to consider the advisability of sending us more news items for our Construction News columns.

A WISE CONCLUSION.

1413-1417 Chamber of Commerce,
Chicago, July 6, 1895.

Gentlemen:

We have concluded hereafter always to advertise our lettings in the Engineering News, as we find we have received more bids from an advertisement in your paper than any other publication.

Yours truly,
Hill & Enricht,
Civil and Consulting Engineers.

NO OTHER PAPER NEEDED.

Boston, Mass., Aug. 17, 1895.

Engineering News Publishing Co.,
New York City.

Gentlemen: The fact that you were unable to make the change we noted a few days ago is of no particular importance and therefore will not inconvenience us.

We wish, in passing, to compliment you on the completeness of your work in the matter of Construction News. Heretofore we have examined and made use of these items from a number of other papers, but we now find that we can save time and yet get as full information by confining ourselves exclusively to your columns.

We have to thank you for most courteous treatment of ourselves and our interests.

Yours very truly,
Carson Trench Machine Co.,
Fred V. Fuller, Manager.

FACTS WORTH CONSIDERING.

Engineering News is probably read by a greater number of prominent contractors each week than are any other five papers in this country. It prints more reliable news items and a larger number of proposal advertisements than any other paper. The columns of this paper are invaluable if one wishes healthy competition for furnishing materials or for construction. Contract work of all kinds should be advertised in Engineering News.